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# LABORATORY PROGRAM MANAGERS GUIDE. PART I. STATEMENT OF WORK PREPARATION

Air Force Systems Command
Washington, D. C.

June 1975

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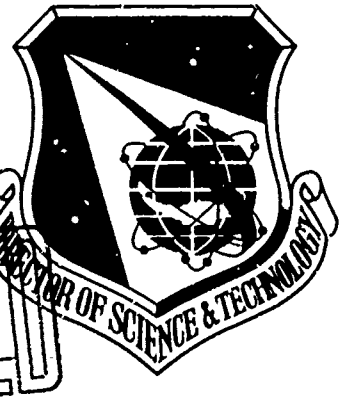
# LABORATORY PROGRAM MANAGERS GUIDE
# PART I
# STATEMENT OF WORK PREPARATION



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## HEADQUARTERS AIR FORCE SYSTEMS COMMAND

### ANDREWS AIR FORCE BASE, MD

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The primary objective of this guide is to provide laboratory level project engineers with a systematic approach for Statement of Work (SOW) preparation The systematic approach presented should enable a project engineer to review and understand all factors that bear on this project BEFORE the Statement of Work is attempted. Statement of work review procedures are recommended to assist the project engineer identify

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and correct any gaps between what he intended to write and what he has actually written. The need and purpose for format consideration is also discussed.

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## PART I

## STATEMENT OF WORK PREPARATION

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## FOREWORD

The primary objective of this pamphlet is to provide laboratory-level project engineers with a systematic approach for Statement of Work (SOW) preparation. It was written by project engineers who are experienced in SOW writing. The systematic approach presented should enable a project engineer to review and understand all factors that bear on this project BEFORE the writing of a statement of work is attempted. It facilitates the orderly identification and sequencing of project requirements, tasks, criteria, and milestones in light of the project schedule and resource constraints. The application of the recommended methodology affords the SOW writers with the opportunity to assure themselves of a thorough and realistic understanding of project requirements. Such an understanding is prerequisite to the preparation of a meaningful and specific SOW which industry, in turn, will be able to both understand and accomplish.

Statement of work review procedures are recommended to assist the project engineer identify and correct any gaps between what he intended to write and what he has actually written. The need and purpose for format considerations is also discussed. Frequently experienced pitfalls in SOW content are presented and reviewed with the intention of helping a project engineer avoid them in future SOWs. A chapter on the legal implications of the SOW is included to familiarize project engineers with some legal rules pertaining to SOW requirements interpretation. Finally, some recommendations are proposed to help a project engineer assure himself of the receipt of quality technical proposals from industry that are truly responsive to the requirements of his statement of work.

This handbook was prepared under the sponsorship of HQ AFSC/DL by the Air Force Institute of Technology, School of Logistics (AFIT/SLC), Wright-Patterson AFB, Ohio. Major Fredrick T. Dehner, Director, AFIT Course 475, Laboratory R&D Management, directed the handbook preparation. Co-authors from the AFSC Laboratories were: Captain William G. Cathey, AFATL; Captain Edward L. Wallace, AFAL; and First Lieutenant Roger A. Mickish, AFWL.

It is intended that this pamphlet complement AFSCP 800-6 and other regulatory documentation that pertains to SOW preparation. Since there are a multitude of formally accepted titles for the personnel within the AFSC (DL) Laboratories who write SOWs and manage the resulting contractual R&D efforts, the expression, project engineer, is used as a general label to circumvent the title problem.

# CHAPTER 1

## THE RESEARCH AND DEVELOPMENT STATEMENT OF WORK

### INTRODUCTION

On an annual basis, Air Force Systems Command is awarding or administering more than 16,000 contracts valued in excess of 43 billion dollars with more than 5,000 different contractors. The basis of each of these contracts is a document called a Statement of Work (SOW) which identifies what the contractor is to accomplish on behalf of the product divisions or laboratories of Air Force Systems Command. The specific efforts defined for contractor accomplishment in this document range from small basic research studies to the acquisition of new major weapons systems. The clarity, accuracy, and completeness exhibited in the SOW content will determine, to a large degree, whether the objectives of the contract will, in fact, be achieved.

### DEFINITION

Within the frame of reference of the laboratories of the AFSC Director of Science and Technology, the Research and Development SOW takes on the following meaning:

The Research and Development Statement of Work identifies four specific technological objectives:

a. The requirement(s) to be fulfilled.

b. The reason for the requirement(s).

c. The tasks to be performed to satisfy the requirement(s).

d. The points of responsibility for task accomplishment.

In Section IV, Special Types and Methods of Procurement, Part I - Procurement of Research and Development of the Armed Forces Procurement Regulations, additional insight

is provided concerning Research and Technology Statement of Work, that is:

4-105 Statement of Work.

(a) The preparation and use of a clear and complete statement of work is essential to sound contracting for research and development. In research, exploratory development and advanced development, statements of work must be individually tailored by technical and contracting personnel to attain the desired degree of flexibility for contractor creativity, both in submitting proposals and in contract performance. Careful distinction must be drawn between level-of-effort work statements, which essentially require the furnishing of technical effort and a report on the results thereof, and task completion type of work statements which often require development of tangible end items designed to meet specific performance characteristics.

(b) In preparing statements of work, the following elements shall be considered:

(i) a general description of the required objectives and desired results;

(ii) background information helpful to a clear understanding of the requirements and how they evolved;

(iii) technical considerations, such as any known specific phenomena or techniques;

(iv) a detailed description of the technical requirements and subordinate tasks;

(v) a description of reporting requirements and any other deliverable items, such as data, experimental hardware, mock-ups, prototypes, etc.; and

(vi) other special considerations.

## THE RESEARCH AND DEVELOPMENT STATEMENT OF WORK DILEMMA

Research and Development projects, quite frequently, are intrinsically uncertain and susceptible to change. The project engineer preparing an R&D SOW faces the demanding challenge of writing a statement of work that is adequate for the government, for procurement purposes,

and for prospective contractors. A fundamental dilemma (see Figure 1) is experienced. The SOW should be definitive enough to protect the government's interest (return on investment) yet flexible and broad enough to encourage industry interest and allow the contractor's creative effort to be added to the program (Simulation of Contractor Scientific Creativity). The project engineer is responsible for the creation and maintenance of the delicate balance that is needed between these conflicting extremes.

Statements of work for research, exploratory or advanced developments can widely vary from simple statements of objectives to complex statements of performance requirements. Regardless of their simplicity or complexity, a properly planned and expressed SOW is the heart of any R&D contract with industry. The success of any contractor's effort to satisfy the requirements of the contract is inextricably dependent upon the capability of the project engineer to generate a clear and specific SOW.

## GENERAL PRINCIPLES FOR RESEARCH AND DEVELOPMENT STATEMENTS OF WORK

The following general principles apply to all R&D Statements of Work:

a. The SOW must not be so narrow that it stifles the contractor's creative effort as a result of government over-direction. The most capable and desirable sources may be hesitant to submit proposals in response to this type of SOW. In addition, if a contract were awarded, experience has shown that supplemental agreements may have to be incorporated into the basic effort to allow for changes precipitated by a subsequent broadening of SOW constraints.

b. The Government does not award contracts for completely undirected research and development. If the R&D SOW is written in too broad a manner, firms may not choose to respond because of the risk involved, the inability to relate work requirements to their talents and capabilities, or because of pricing difficulties. While unnecessarily restrictive R&D SOWs are usually undesirable, they must be specific in their descriptions of desired objectives.

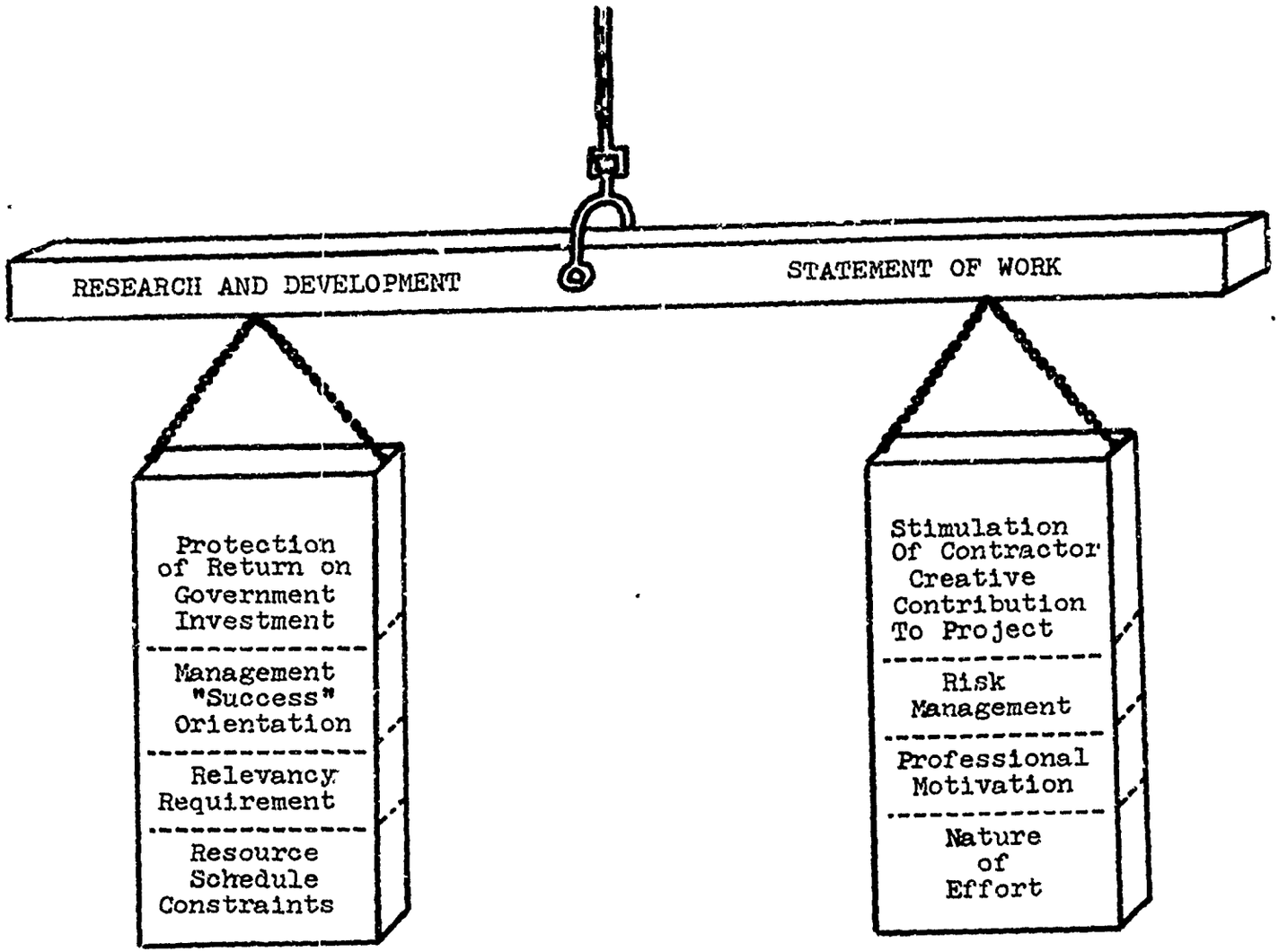


FIGURE 1 - The R&D Statement of Work Fundamental Dilemma

c. A contractor, taking his ultimate direction from the SOW alone, should be able to perform the required work. The objective of writing a statement of work is the achievement of an agreement and understanding with a contractor concerning the specific nature of the technical effort to be performed. The SOW serves as the nucleus of a contract, that is, an agreement between competent parties (the government and a contractor) for a valid consideration (the government's payment of a price for the contractor's promise of performance) to accomplish a lawful purpose with terms and conditions clearly and specifically set forth. The adequacy of this contract to properly represent the effort to be performed is a direct function of the quality, clarity, and completeness of its statement of work.

d. The very nature of research and development is such that it may be difficult to arrive at a complete understanding with the contractor regarding the technical effort to be performed. R&D SOWs are based upon the known and usable portions of the technological base. The project engineer should search for and locate the existing knowledge upon which his effort shall be based. Since it is virtually impossible for one person to be the source of this knowledge, it is in the best interests of the project engineer to convene a team of knowledgeable experts from within the government who can assist him in determining the current technology base and in preparing the statement of work.

e. Quite frankly, R&D efforts are directed at tasks that are beyond the state-of-the-art. Consequently, it cannot be logically expected that a contractor shall always be able to accomplish the desired or sought-after result. Therefore, the form of the contract to be awarded for R&D efforts should be compatible to the nature of the effort to be performed. A completion contract should be used when the contractor will be required to complete and deliver to the government a specified end product, that is, experimental hardware, new methods, demonstrations, or other tangible results. A level-of-effort contract is more appropriate for study and early development work. Such a contract essentially sets forth the level-of-effort to be performed by the contractor and its time period. It requires the contractor to furnish technical or professional effort and a report of the results of the effort. A phase option type contract divides the R&D effort into successive phases where a given phase must be accomplished before the next phase is started. Such a contract is more manageable and facilitates the government identification and monitoring

of contractor progress. Early detection of unsatisfactory contractor progress is additionally permitted by phasing. It provides the government with the opportunity to re-evaluate and, if necessary, redirect the effort in a timely manner.

f. The element of risk inherent in R&D SOWs will affect the compensation arrangement of the contract written. For example, for level of effort type of contracts, a firm fixed price compensation may be feasible. If the amount of contractor effort (performance, time, and cost goals) is extremely uncertain at the outset, then a cost reimbursement compensation may be necessary because of the inability to estimate costs with any reasonable degree of accuracy. For efforts where it is desirable to motivate and reward contractor initiative and creativity in pursuit of desired objective, incentive-type compensations may be appropriate. The relationship of risk inherent in R&D efforts to the type of compensation arrangement selected for the contract is discussed in more detail in Appendix A.

g. The SOW not only affects the number of qualified sources willing and able to prepare proposals for the work, it also influences the proposers' approaches to the R&D effort. It additionally has a direct impact on the government's evaluation of proposals. Proposal evaluation must be based on the SOW, that is, on what the project engineer and his SOW preparation team have stated they desire the contractor to pursue.

h. The SOW impacts on the administration of the contract. It defines the scope of the effort, that is, what the contractor does and what the government receives. The manner in which the scope is defined will govern the amount of direction that project engineers can give and what the contractor will accept during the contract's life. Any changes in the scope of an active contract's SOW require formal contract modification and may precipitate increased and possibly unnecessary contract costs.

i. It is of paramount importance that project engineers guide their SOW writing efforts so as to make more than one interpretation virtually impossible. This is a most demanding communication challenge. The SOW is read, interpreted, and acted upon by government and contractor personnel of widely varying backgrounds, that is, scientists, engineers, functional experts, contracting officers, buyers, price analysts, negotiators, lawyers, and contract administrators (to list a few).

## THE PROJECT ENGINEER AND HIS STATEMENT OF WORK

The project engineer of an R&D program is entrusted with the responsibility of managing all aspects of his assigned program. Commensurate with that responsibility is the expectation, on the part of all levels of project engineer supervision, that the R&D effort will have its resources manage in an efficient manner. It is assumed that any resulting contractual effort will be directed toward the achievement of the desired R&D objectives. This expectation shall only be realized if the project engineer concerned exercises meticulous care in the preparation of clear and comprehensive statement of work for the effort. The project engineer needs to keep in mind that a well-written SOW will favorably affect:

a. The motivation of contractors toward quality proposal preparation;

b. The number and variety in approach of proposals submitted by industry;

c. The number of contractor misunderstandings while they are writing their proposals;

d. The evaluation of technical proposals;

e. Improved cost proposals from industry on the R&D effort to be performed;

f. Contract price and technical negotiations;

g. The form and compensation arrangement in the awarded contract;

h. Reduced contract costs; and

i. Improved administration of the contractual effort.

Most important to the project engineer is the fact that a well-written statement of work enhances the contractor's performance in pursuit of SOW objectives. Clear SOWs will permit meaningful communication to and understanding by the contractor of the technical effort to be performed.

## TRADITIONAL STATEMENT OF WORK PREPARATION TECHNIQUES

Probably no aspect of the total R&D procurement process has received less attention than the preparation of meaningful guidelines to assist project engineers in determining HOW to plan, organize, write, and review their statement of work for R&D contractual efforts. Many formats are available for project engineers to consider in the structuring of SOW content. However, the subject "How to Begin" the development of SOW content has received only scant attention.

As a result of this information void, project engineers have written SOWs by the "trial-and-error" method, the "scissors-and-scotch tape" approach, and rarely, by contractor dictation.

The "trial-and-error" method of SOW preparation is the procedure used most frequently by project engineers. It results in numerous rewrites of the SOW prior to and during negotiation and occasionally necessitates contract modification after contract award. The waste of both government and contractor time and the high potential for incurring unnecessary increased contract costs, schedule slippages, and deficiencies in technical performance are the obvious disadvantages of this method of SOW preparation. The waste can be compounded if project engineers persist in using this method on subsequent SOWs without taking into consideration the lessons learned from previous "trial-and-error" attempts. The best that can be hoped for with "trial-and-error" statements of work are contractor proposals, negotiations, contracts, and contractor performance that all reflect the "trial-and-error" philosophy of the SOW. The project engineer cannot afford to allow this type of deficiency to gain control of his R&D program.

At times, a project engineer finds himself in a situation where he does not have sufficent time, due to organizational deadlines, to write a quality statement of work. Under these circumstances, SOWs are removed from folders for projects of a similar nature and the project engineer's "scissors-and-scotch tape" get a thorough workout. The danger of this approach is that incoherent, incomplete, inconsistent, antiquated, or possibly irrelevant paragraphs get introduced into a statement of work. In some cases, they elude the technical, procurement, and negotiation review process. They do not get detected until

contractors have wasted resources trying to integrate them, in a meaningful manner, into the contractual effort. A project engineer would never allow a contractor to utilize a "scissors-and-scotch tape" approach in his fulfillment of contract requirements. With equal vigor, he should never allow himself to be forced into using the "scissors-and-scotch tape" approach to statement of work preparation. Experience has shown that there can be no substitute for a thorough and well-written statement of work.

Contractor-prepared statements of work are specifically forbidden by procurement regulations. This prohibition is based on sound reasoning. Contractor-prepared SOWs give an excessive competitive advantage to one contractor to the detriment of all other contractors who might possess the capability to perform the desired effort. The effect of this practice might be the refusal of qualified contractors to participate in the development of certain segments of the Defense Department's technological base. This is contrary to the purpose of all federally funded research and development, that is, the advancement of the scientific and technological base of our nation. In addition, contractor dictated SOWs could virtually deny the government prerogative of the technical management and direction of its R&D contracts. Finally, contractor-prepared SOWs can be protested legally on the grounds that they, in reality, may deny the award of contract to all qualified contractors who did not have the advantage of assisting in the SOW preparation. In addition to the obvious problems which this protest may precipitate, it is reasonable to expect that any resulting procurement action will be substantially delayed.

## HOW TO BEGIN

The question of "How to Begin" the preparation of a statement of work is the core subject area of this pamphlet. Before writing a statement of work, a project engineer must develop a thorough understanding of all of the factors that will bear on his project and will be reflected in his SOW. His methodology must be thorough, logical and realistic. Understanding of the project must precede and dictate the documentation and implementation of the project and not vice versa.

In order to assist project engineers in pursuing a systematic approach to SOW preparation, the task of developing a SOW has been broken down into four distinct areas; that is, planning, organizing, writing and format considerations for SOW preparation. They are the subject of the next four chapters.

## CHAPTER 2

## PLANNING THE STATEMENT OF WORK

### PURPOSE OF PLANNING PHASE

A statement of work has frequently been described as a document that details a strategy for contractor and government accomplishment of the objectives of an R&D project. But before any strategy can be developed by a project engineer, certain basic questions must be answered and understood, that is,

a. What are the objectives of the project;

b. Where did the objectives come from, who originated them, and why were they originated;

c. What is the current status (state-of-the-art, resource, and schedule constraints) for the effort; and

d. Based upon current status, what is the risk factor associated with the achievement of project objectives?

A project engineer is expected to be an expert on not only all of the technical factors that bear on his project, but all of the background information which establishes and delimits his project. He cannot effectively manage his project if he concentrates on the technical factors and does not develop a thorough understanding of the background information for his program. This chapter recommends a procedure that will enhance project engineer understanding of background information - the prerequisite to delineation of tasks and organization.

### PLANNING PHASE CHECKLIST

Simply stated, the planning phase of SOW preparation is aimed at a thorough investigation of the why and what for the project. The following checklist should assist him in this determination:

a. Understand the origin and purpose of the project. The project engineer should be able to identify, at the outset, the relevancy requirement for his project. Why should the Air Force commit financial and manpower resources

to this project? In what specific manner does this project have a direct and apparent relationship to current or future AF needs? Who initially identifies the need? How and where is it identified, and what is really asked for? The answers to these questions can be found in the planning and programming documentation for the project. Depending on the nature of the project, the answers may be found in a Required Operational Capability (ROC) Document, Technology Need (TN), In-House Basic Research documentation, exploratory or advanced development plans, Project Management Directives, technology planning guidance or other appropriate documentation. On existing projects, the project engineer should find the applicable documentation, or reference thereto, in the project folder. For new efforts, the project engineer's supervisor or the laboratory plans and programs office should be able to identify the applicable documentation.

b. Identification and Analysis of Current and Previous Efforts related to Project. The purpose of this investigation is to determine previous accomplishments and similar efforts that have a direct bearing on the project engineer's program. These efforts may fall under the technical jurisdiction of the project engineer's laboratory or other AF or, DOD R&D organizations. In order to make this determination, the project engineer should initially use the most available resource at his disposal, that is, the experienced project engineers in his own laboratory. Then a Defense Documentation Center literature search should be requested through the Base Technical Library in order to secure information on all previous and current DOD efforts that may contribute to the project engineer's effort. The end result of this exercise will be an answer to the following question, that is, "What is the current status of the DOD technological base upon which the project engineer's effort will be built?". The answer should assist him in avoiding any unnecessary duplication of effort.

c. Conduct a Literature Search to Determine Current "State-of-the-Art". There are numerous professional journals and articles that may not surface during Step b, but will have a direct impact on project status determination and research requirement identification. Experienced co-workers, professional colleagues, and technical librarians will be invaluable to the project engineer in conducting this search. In addition, the laboratory Independent Research and Development (IR&D) monitor in the Plans and Programs Office may be of assistance in identifying the current industry state-of-the-art and associated IR&D funding levels for your project.

d. Determine/Verify the R&D Category for the Project. As a result of information gained from Steps a and c, the project engineer understands the nature of the requirement and the status of the technological base upon which his project will be built. He can now determine whether his project is within, at, or beyond the current state-of-the-art and consequently assess the technical risk associated with his project. This risk determination will have a definite impact upon the accomplishment of project objectives and the resultant management scheme that evolves for the project.

e. Identify the resource, schedule, and compensation arrangement constraints for the project. Now that the project engineer has specific grasp of the nature and magnitude of his project's objectives, he should identify any schedule and resource constraints which have been assigned to his project. The type of contract to be awarded must be compatible and consistent with the risk involved in the effort. Appendix A may serve as a useful guide during this determination.

f. Determine the existing Statement of Work Routing/Coordination Policies and Procedures in the Laboratory. The project engineer should thoroughly understand all of the requirements of his laboratory's SOW coordination cycle well in advance of the actual SOW coordination. He should brief all elements in the cycle on the nature of his project and solicit their assistance with respect to specific SOW preparation guidelines. The pre-coordination will minimize the number and extent of SOW rewrites required during the final coordination cycle.

g. Identify all military specifications/standards and other relevant documentation applicable to the project. The project engineer should consult with all of the laboratory functional experts who represent disciplines that will have impact on his effort. An early identification of this impact will permit a timely and integrated incorporation of relevant documentation into the task descriptions of the SOW.

SUMMARY

As a result of the foregoing analysis of the background information on his project, the project engineer is able to direct his attention to the tasks that need to be accomplished in pursuit of project objectives. He now possesses an

understanding of the origin and reason for his project, the state-of-the-art upon which his effort will be based, the constraints that have been placed on his project, the amount of risk involved in his effort, and the SOW coordination cycle and functional discipline requirements that will have to be incorporated into his SOW preparation efforts. He is now ready to enter the organizing phase of SOW preparation, the subject matter for the next chapter.

## CHAPTER 3

## ORGANIZING THE STATEMENT OF WORK

### PURPOSE OF ORGANIZING PHASE

Proper organization of the technical effort is a mandatory prerequisite to the preparation and use of a clear and complete research and development statement of work. One of the best ways that a project engineer can assure himself of a complete, orderly, and integrated SOW is by the preparation of an outline which will structure and sequence the technical effort and all its interdependencies. A good technical effort outline will:

a. Aid in the analysis of the project engineer's ideas concerning the R&D requirement(s);

b. Aid in organizing the description of the technical requirement(s) and provide smoothness and continuity;

c. Help avoid significant omissions;

d. Help eliminate unnecessary and duplicative tasks in the efforts; and

e. Allow the project engineer to focus his complete attention toward the effort for which he will prepare a statement of work.

### ORGANIZING PHASE CONSIDERATIONS

In preparing the outline of the technical effort, the project engineer should direct his primary attention to a precise statement of project objectives, the tasks to be performed in pursuit of those objectives, the identification of task sequencing and interrelationships (phasing, if appropriate) and the specific areas for required contractor effort. Depending upon the nature of the R&D effort, the risk involved, and any internal laboratory and procurement programs and procedures, the following efforts should be considered and, whenever appropriate, included in the outline:

a. Specifically identify the desired end objectives (product or service) of the project and its associated technical requirements, that is, (technical goals, design parameters, performance characteristics, test criteria, etc.).

b. List background information that will aid in a clear contractor understanding of the nature and origin of the R&D requirements. If appropriate, relate the project to the major program and its goals.

c. Establish the scope or limits of the contractor's effort in support of project objectives. Clarity of expression is essential here. Any subsequent effort by the contractor beyond this scope will necessitate changes and require new negotiations of cost, fee and schedule. In addition, clarity in the scope of the effort is the basis for subsequent measurement of contractual changes and progress.

d. Delineate technical considerations (that is, known phenomena, methodology, previous efforts, or interface requirements with other projects) which may influence the contractor's technical approach or efforts.

e. List the specific tasks and subtasks to be accomplished by the contractor to satisfy the desired end objectives of the effort, that is, the contractor effort to be accomplished to satisfy technical requirements.

f. Sequence the tasks in the order of accomplishment. Identify and exhibit in this sequencing all task interdependencies.

g. Establish relevant parameters for contractor performance measurement. These parameters will serve the following purposes: (1) contractor adherence to pertinent contractual efforts, (2) measurement of the completed contract results, (3) definition assistance with respect to the relationship of subsequent changes and redirection of effort to the defined scope of the effort, and (4) project engineer and contracting officer monitoring of contractor progress. The Government's and contractor's ability to assess the contractor's effectiveness in satisfying contractual terms is directly dependent upon the SOW identification of measurable schedule, cost, and technical performance goals.

h. Establish milestones or government management control points in the task sequencing where government review/approval or acceptance/rejection actions are to be introduced. These controls are vitally important for incorporation into the SOW content at the end of all tasks which require a government decision before the contractor proceeds to the next SOW task. They are particularly applicable for phase type contracts where it is necessary

to detect unsatisfactory contractor performance at an early stage. It will allow a project engineer to inform procurement personnel of unpromising contractor actions which should be terminated before their effect compromises the entire R&D effort.

i. Identify the management information requirements which the contractor must satisfy in order to assure contractor feedback in support of project progress determinations by the project engineer against the established milestones and associated performance measurement criteria.

j. Identify all government and contractor participation needed for the project and the extent and nature of their task responsibilities. All tasks requiring government support (government furnished equipment, materials, facilities and extra-laboratory government agency assistance) prior to contract initiation and accomplishment of tasks should be specifically stated. The nature of the government support to be provided should be specifically presented.

k. Certify that the tasks identified and their sequencing and interrelationships support the technical requirements.

l. Generate a schedule for the sequence of tasks to be performed by the contractor.

m. Precisely identify contractor delivery requirements and dates. Include details about the type and quantity of all deliverable (for instance, prototypes, theoretical models, breadboard models, mockups, computer software, drawings, documentation, reports or other data).

n. Specifically identify all technical data requirements. Include the intended use for the data by the project engineer.

o. Identify any other specific considerations based upon the nature of the required R&D effort (contractor derivation of theoretical models and equations, validation of statistical sampling techniques, etc.).

p. Estimate, when allowed, the professional and technical man-hours, man-months, man-years, etc., required to perform the R&D effort by the contractor. This information will provide a common basis for realistic proposals and meaningful technical and price analyses of the resultant proposals.

## THE STATEMENT OF WORK OUTLINE VERSUS THE PROJECT CONSTRAINTS

After a project engineer has prepared a detailed outline of his R&D project requirements, he needs to assess the impact of the real-world resource, schedule, and contract type (compensation arrangement) constraints that have been prescribed for his project. A determination must be made as to their compatibility with the nature of the R&D project (the risk involved and the outline of tasks that has just been developed for his project). This can best be illustrated by Figure 2.

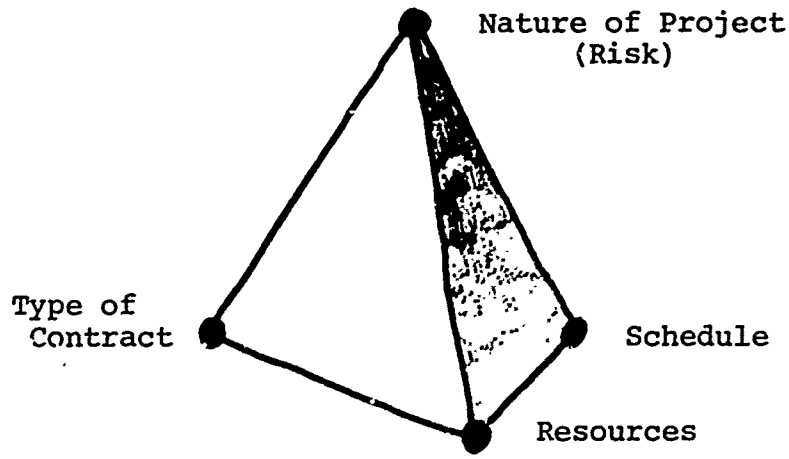


FIGURE 2 - The R&D Project Tetrahedron

The amount of an R&D project that can realistically be performed may, by analogy, be perceived as being restricted within the interior of a tetrahedron whose vertices represent the project constraints and the technical risk associated with the project. After the project engineer has developed the detailed outline of tasks for his project, he must determine whether his project, as tasked, will fall within a complex interrelationship of constraints. A thorough understanding will be required concerning the nature of these constraints, their interrelationships, and the impact of trade-offs between these constraints. In addition, the project engineer needs to develop an in-depth appreciation of the consequences associated with constraint trade-offs and their effect on the accomplishment of overall project objectives.

When the project, as outlined, cannot be accomplished within the schedule and resource constraints assigned to the project, the project engineer may need to eliminate, combine, or resequence tasks to accommodate the constraints. Alternatively, he may pursue constraint broadening to permit project accomplishment as planned and organized. The detailed project understanding and task sequencing accomplished by the project engineer as a result of following the guidance provided in Chapters 2 and 3 of this handbook may allow him to establish a creditable justification for project constraint broadening. In many instances, the final solution to the problem of insufficient resources and schedule for an R&D project may be a compromise position. Tasks are eliminated, combined, or resequenced concurrent with a broadening of project constraints. Once the problem has been resolved, the project engineer should reassess the technical risk associated with his project. He will then need to identify a type of contract compensation arrangement that fairly and reasonably distributes project responsibility/risk sharing between the government and industry for the technical effort to be performed.

CHALLENGE ALL STATEMENT OF WORK REQUIREMENTS

In addition to resolving any conflict between project constraints and the project detailed outline, a project engineer should objectively challenge all aspects and tasks in his project prior to the writing of a statement of work. The following questions may prove helpful in this analysis:

a. Why is the task needed in the project?

b. Does it contribute tangible utility to the project?

c. How much does the task cost in terms of the technical effort to be performed?

d. Is the value of the task to the project worth the associated cost?

e. Is there another way to accomplish the task? Has it been evaluated?

f. What is the impact on the overall project if the task is deleted from the project?

The project engineer is the only person qualified to answer these questions directed at his project. It is time well spent if the project engineer has answers for these questions BEFORE they are asked during a project review or the SOW coordination cycle.

## SUMMARY

The thorough organization of a detailed outline provides the project engineer with the list and sequencing of the tasks which the contractor is to do and those tasks which the government must perform or support. It provides him with an opportunity to enumerate and study his concept before commencing the actual writing of the SOW. Inconsistencies, gaps, interrelationships among concepts, relationship to objectives and logical organizing are more visible to the project engineer when he prepares his SOW from a detailed outline. Such a practice avoids unnecessary changes, insertions, and deletions. Finally, a detailed SOW outline permits the writer to concentrate on the development of one idea at a time since decisions on total content and task sequencing have already been made.

As a result of the organizing phase of SOW preparation, the project engineer has a detailed understanding of project requirements and the effort that can be accomplished within project constraints. Because of his objective challenge of project requirements and tasks, he can provide a justification for all of his project tasks and can provide a creditable argument for project constraint broadening. He is now in a position to write a clear and precise statement of work.

## CHAPTER 4

## WRITING THE STATEMENT OF WORK

### INTRODUCTION

As a result of a thorough planning and organizing of the R&D effort, the project engineer knows exactly the details and tasks that need to be included in the Statement of Work. Now he must address the task of documenting in a meaningful and coherent manner all of the requirements and tasks for the project. There is a world of difference between the project engineer's knowledge of what has to be documented and the actual documentation thereof. Will he be able to write what he means and mean what he writes in his statement of work? Will all potential contractors possess the same understanding of project requirements as the project engineer?

### HOW TO TRANSITION INTO THE WRITING PHASE

It is not an easy task for a project engineer to write a quality statement of work. As was discussed in Chapter 1, the statement of work must maintain a delicate balance between protection of the government's return on investment and the simulation of contractor creativity during both proposal preparation and contract performance. In addition, the SOW must be read and understood by government and contractor personnel of widely varying expertise. Finally, the SOW must be specifically tailored to the nature of the R&D effort to be performed. As a result, it can be logically concluded that the task of preparing a quality statement of work may exceed the talents of the individual assigned management responsibility for the R&D effort, namely, the project engineer.

With these points in mind, the project engineer must determine what will transform his plan and detailed outline into a successful R&D project before he starts to document it. The following points may assist him in making this determination:

a. Review the SOW for the successful R&D efforts in his laboratory. It cannot be assumed that successful R&D efforts always contain quality statements of work. However, the chances are exceptionally small that a poor statement

of work resulted in a successful R&D project. Consequently, by reviewing these SOWs a relationship may appear between the way an SOW requirement was written and the contractor's accomplishment of the requirement. In some instances, outstanding contractor performance may be found in spite of the way in which the SOW was written. This detection may enable a project engineer to realize the way the SOW requirement should have been written. He may be able to use all of these findings in the preparation of his own statement of work.

b. Consult with project engineers experienced in SOW preparation. As was described earlier, one of the traditional SOW preparation techniques is the "trial-and-error" technique. Fellow engineers may be invaluable in the identification of the problems they have experienced in writing a SOW. If a project engineer can detect the basis of their "trials" and the nature of the resultant "error," he may be able to preclude the same mistake from being incorporated into his SOW.

c. Review the procurement and technical coordination channels and procedures. Although project engineers frequently take a dim view of these channels and procedures, there are numerous excellent reasons for their existence. An open-minded attitude toward them on the part of the project engineer may substantially improve his chances for a quality SOW. First of all, although a project engineer is singularly responsible for the management of all aspects of his project, he cannot be a knowledgeable expert on all of these aspects. He must seek out and utilize the guidance of all of the functional experts that have a concern and interest in his program. Secondly, the functional disciplines required in his project must be specifically tailored to the overall effort. The only way in which this perspective can be efficiently introduced into a statement of work is by a close working relationship between the project engineer and the functional experts.

d. Review the SOW format requirements contained in AFSC and other laboratory or local procurement regulations. Although the subject of format will be presented in detail in the next chapter, a project engineer is well advised to be familiar with this format while he is finalizing his organization of ideas prior to writing the SOW.

e. Avoid the "Pride of Authorship" syndrome. This word of advice is easy to give, but at times exceptionally difficult to follow. Quite frequently, the writing of an SOW can realistically be described as a long, drawn out battle. Statement of work preparation is quite a time consuming process in which a project engineer has a deep psychological involvement. He is the acknowledged expert in the laboratory for the technical subject matter of the SOW. However, at times, he may prematurely judge the advice of technical or procurement personnel as being the input of "meddlers" who are not accountable for the impact of their advice on the project goals. In addition, the time delays precipitated by rewrite instructions from these personnel are considered to be exorbitantly long. Such an attitude is symptomatic of a complex problem in the SOW preparation and coordination process. It warrants further discussion.

If the author of a statement of work waits until he has written the document before he coordinates it with procurement and laboratory personnel, it should be logically expected that he will be sent back, on numerous occasions, to revise his SOW. The resulting frustration and annoyance of the project engineer is understandable but, unfortunately, he brought it upon himself! Does a project engineer belong writing unilateral technical requirements into his SOW for areas in which he may have no technical expertise? More important, what are the consequences that can impact on his project if he persists with such a practice? It could very well be in the best interests of his project that he make the changes toward which he may be opposed to. Consequently, all recommended changes must be reviewed objectively by the project engineer. He must be ready and willing to rewrite his entire SOW, if necessary. Hard writing, coupled with appropriate rewriting, is the only way to assure an SOW that can be easily read and understood by potential contractors. There have been a number of quality statements of work written by project engineers; but, more frequently, weak statements of work get prepared. No one has ever written a perfect statement of work! Consequently, the point made in paragraph c above should be seriously pursued by a project engineer if he wants to minimize the number of rewrites that may be required for his SOW before it is transmitted to industry for proposal preparation.

## GENERAL CONSIDERATIONS FOR STATEMENT OF WORK WRITING

The task of writing a quality statement of work exhibits the same problems for a project engineer as the writing of a graduate thesis, doctoral dissertation, technical report, or an article for a professional journal. General faults which are frequently found in any of these documents are long sentences and paragraphs; abstract, vague or ambiguous terminology; and excessive or irrelevant material.

The R&D statement of work must be written with the purpose of clearly, concisely, and thoroughly defining all of the obligations of the contracting parties with respect to the technical effort to be performed. The language contained therein should be consistent in terminology application and free from redundancy and ambiguity.

The requirement that the SOW be complete in all details is a prerequisite to the contractor's understanding of the intent of the program. Incomplete SOWs may precipitate contractor refusals to submit proposals. In addition, they may force contractors to guess the intent of the program. This may result in a delay in contract negotiations while the SOW is rewritten properly. In rare instances, R&D projects have been terminated due to an overall industry lack of understanding and responsiveness to incomplete SOWs. Consequently, a very appropriate question for a project engineer to ask while he is writing his SOW is "Will the prospective contractors be able to understand the requirements of the SOW?".

Upon receipt of a Request for Proposal (RFP), contractors carefully evaluate the advantages and disadvantages of proposal evaluation before they decide to submit a proposal. It costs a company thousands of dollars if they commit resources to preparing a proposal. The extent of the balance between the talents in the contractor organization and the value of the R&D effort to its overall organizational goals are carefully studied. The contractor's ability to interpret and understand the SOW requirements will be the ultimate basis of his proposal decision. As a result, if more than one interpretation of SOW requirements is possible, it is logical to expect the contractor to select the interpretation that is the most favorable to his company. Unfortunately, the contractor's interpretation of the SOW and the intended government meaning are not always the same. For this reason, project engineers are advised to write their SOWs in such a manner as to make more than one interpretation impossible.

There is a natural tendency for writers to expand or contract their sentence or paragraph length as a function of the complexity of the idea to be expressed. Complex ideas may force SOW writers into unnecessarily long statements of requirements. As a result, the readability and understandability of the idea expressed may be compromised. Project engineers should make a deliberate effort to avoid this problem in their SOWs. Keep sentences and paragraphs as short as possible. A well planned arrangement of ideas within sentences will additionally minimize the necessity of excessive punctuation.

When documenting technical or performance requirements in a statement of work, it is highly desirable to use conventional language to the maximum extent practical under the circumstances. The intent is not to completely eliminate technical language. The language used should be reduced to the essentials required for requirement/task description. Excessive technical verbiage may obscure the real requirement. In addition, it may affect the number of good sources willing and able to respond with proposals.

Abstract language should be avoided in preparing the statement of work. The use of such words will all but guarantee differences of opinion between the contractor and government with regard to what was intended in the SOW. The competitive nature of the resulting technical proposals may be effectively precluded by the use of abstract terminology. Furthermore, such terminology will, most probably, generate numerous misunderstandings during the life of the contract.

All provisions documented in the statement of work should directly contribute to the accomplishment of the R&D project. Irrelevant requirements should be deleted because they unnecessarily contribute to the cost of the effort. "Nice to Have" or "Job Security" type requirements should be removed from the list of mandatory requirements. When in doubt concerning the relevancy of certain requirements, the following questions should be asked and answered to the satisfaction of the project engineer:

a. Does the requirement specifically tell the contractor the task to be accomplished?

b. Is the requirement necessary for the contractor to determine the task to be accomplished?

While the R&D statement of work is expressed in scientific or technical terms, it is also subject to the rules of contract law. The SOW is the heart of the contract awarded to the winning contractor. As a result, it is subject to all the rules of contract drafting and interpretation (Chapter 8 will discuss this subject in greater detail). If the nature of the effort and the language of the SOW are not understood, there will be more areas for misinterpretation in the SOW than in the rest of the contract. Since the rest of the contract supports the SOW, the whole contract may become a meaningless and argumentative package.

Mandatory language should always be used in the SOW for those requirements where contractor compliance or performance is binding. If background information or "reason for the project" type information is to be communicated to the contractor, the project engineer should make sure that this information is segrated from the mandatory requirements. The structure of the SOW should allow a prompt and easy contractor differentiation between why the project was originated and what it will entail in the way of contractor performance.

Redundant requirements should be avoided in writing a statement of work. The only contribution they add to a SOW is verbosity and a possible decrease of contractor understanding of project requirements. As an example, repetition for emphasis serves a valid purpose in an instructional document. However, it serves no purpose in a statement of work.

Regardless of any communication (both oral and written) that takes place between the contractor and the government during the R&D contractual effort, the SOW will be viewed by the contractor as his "Bill of Rights." This is the most important point for a project engineer to remember as he sets out to write his SOW. A project engineer should never be surprised when his contractor proceeds to perform in accordance with the "letter" of the statement of work.

## LANGUAGE OF THE STATEMENT OF WORK

The subject of the language to be used in a statement of work cannot possibly receive sufficient emphasis in this handbook. An ill-chosen word or phrase in a SOW can literally destroy any chance for a meaningful completion of project objectives. There have been too many instances where semantics has ruined a project engineer's contractual effort

to dismiss SOW language as obvious or trivial. The following three subsections will present some SOW language guidelines for project engineer consideration.

a. Basic Language Guidelines

A project engineer should focus his attention on the overall meaning of words used in his statement of work rather than directing a fragmented concern for individual words, paragraphs, or sentences. Words and phrases must be combined with caution in order to assure a clear and specific SOW content. When examples are used in the body of the SOW to illustrate a technical requirement/task, they should be specifically labeled as examples not contractually binding on the contractor.

Words should be used in a consistent manner throughout the SOW. The same words or phrases should be used to convey the same meaning. If a project engineer varies the words selected to express the same meaning, the contractor reading the SOW may look for new meanings for the words. The net result may be ambiguity or contradiction in the technical requirements of the SOW.

There are certain words in our language that are highly susceptible to misinterpretation. Many words have potential double meanings. The word "including" may mean "consisting of" or "consisting of but not limited to." Other words with the built-in tendency for misinterpretation are "similar," "type," "average," and "about." If words of this nature must be used in an SOW, the project engineer should exactly define the term. There are many other words in our language that fit this category. A project engineer should develop a list of these words as he runs into them. Then he will be able to either avoid or specifically use them in future efforts.

Our language also possesses a good number of vague or abstract words. A small sample of such words are "characteristics," "concept," "functional," "implement," "supplement," and "greatly - Words of this nature should be avoided in technical writing.

Technical requirements which essentially constitute an "agreement to agree" at some future date on a particular aspect of the statement of work, can precipitate contractor misunderstandings or problems. Such requirements should not

be included in the statement of work. They cannot be realistically priced out in the contractor's cost proposal. The project engineer cannot assign cost and schedule constraints against accomplishment of such requirements. In addition, their actual specification and negotiation subsequent to contract administration problems which can compromise the completion of the project.

In those cases where a technical requirement cannot be appropriately described by words, an illustration may more quickly and accurately portray what the project engineer really intends. However, illustrations should only be used when they make a definite contribution to the contractor's understanding of the requirement.

b. Statement of Work Phrasing

There are certain phrases frequently used in SOWs to indicate requirements in accordance with existing specifications, drawings, methods, etc. Requirements by reference should be written using standardization expressions similar to the following "in accordance with Specification (or Standard)... " "shall be as specified in Specification...." or "shall be painted with one coat of paint conforming to Specification..." .

When necessary to use the phrase "unless otherwise specified" to indicate an alternate course of action, the phrase should always come at beginning of paragraph. However, this phrase should be limited in its application.

When making reference to a requirement in the SOW and the requirement reference is rather obvious or not difficult to locate, the single phrase "as specified herein" is sufficient.

The phrase "to determine compliance with ..." or "to determine conformance to ..." should be used in place of "to determine compliance to ...". In any case, use the same wording throughout.

In stating positive limitations, the phrasing will be stated as: "The diameter shall be not greater than...". In addition, if a lower limit specification is appropriate, it should also be positively stated.

The emphatic form of the verb shall be used throughout the SOW, that is, in the requirement section state "The indicator shall be designed to indicate..." and in the section containing test provision "The indicator shall be turned to zero and 220 volts alternating current voltage applied." For specific test procedures, the imperative form may be used provided the entire method is preceded by "The following tests shall be performed" or related wording, thus, "Turn the indicator to zero and apply 220 volts alternating current voltage."

The phrase, "The contractor shall take into consideration...." should not be utilized for mandatory technical requirements. There is no way a project engineer can measure or evaluate contractor performance against the requirement to "take into consideration."

The phrase "shall include but not be limited to the following...." is an open-ended SOW requirement. It is occassionally introduced by project engineers who might not be willing or able to specifically identify all of the tasks that need to be performed. It may also be used by the project engineer in an attempt to give the contractor some flexibility in requirement satisfaction. The phrase may precipitate a contract administration nightmare for any type of compensation arrangement contract. For cost type contract, in particular, this phrase may contribute significantly to cost overruns.

c. Statement of Work Caution Words

Some everyday words can be very troublesome in the field of procurement. The following subparagraphs list some of those most commonly misinterpreted:

(1) Guide and Guidance. Do not use the words "guide" and "guidance" as they are subject to varied interpretations. Comply with the following:

(a) If drawings, samples, or other data are to be furnished for information and are not mandatory, state that they are furnished for "information only."

(b) If mandatory that drawings, samples, or other data be adhered to, state "the item shall be in accordance with the drawings (samples or other data)."

(2) Shall, Will, Should, and May. Use these words as follows:

(a) The word "shall" is mandatory and not subject to misinterpretation.

(b) The word "will" is used to express a declaration of purpose on the part of the government; for example, the government will furnish shipping instructions.

(c) The words "should" and "may" are used to indicate nonmandatory or optional provisions.

(3) And/Or. Use of the phrase "and/or" is ambiguous and should not be used. It permits the contractor to make his own choice. For example, instead of stating that the surface shall be painted and/or coated (which has three interpretations), the requirement should be stated as follows:

(a) "The surface shall be both painted and coated" (meaning both methods of protection are required).

(b) "The surface shall be painted or coated, or both coated and painted" (meaning the contractor is given his choice in the method of protection.

(4) Flammable and Nonflammable. The words "flammable" and "nonflammable" are used in lieu of the words "inflammable" and "uninflammable."

A SUMMARY OF THE GUIDELINES FOR SOUND STATEMENT OF WORK WRITING

As a reminder, here is a checklist for the writing of a more easily understandable statement of work:

a. Develop a clear organizational pattern for the SOW.

b. Use acceptable English. Use grammar and punctation functionally. Avoid incomplete sentences. Place all modifiers correctly.

c. Know your readers.

d. Use only necessary words and conventional language to the maximum extent practicable. Make every word count. Use precise and graphic terms.

e. Avoid jargon, undefined acronyms, and unfamiliar words. Write to express rather than impress. Prefer the simple to the complex.

f. Employ a consistent writing style.

g. Write short, meaningful sentences that combine related ideas. Write paragraphs that specifically inform the contractor what is expected of him.

h. Put action in your verbs; write in the active voice. Avoid useless phrases that express a condition rather than an action.

i. Emphasize the main points.

The application of this checklist, coupled with the writing guidelines contained in this chapter and the R&D SOW General Principles of Chapter 1, should materially assist the project engineer in his efforts to write a clear, concise, and complete statement of work.

## CHAPTER 5

## FORMAT CONSIDERATIONS FOR STATEMENT OF WORK PREPARATION

### THE FORMAT REQUIREMENT: BENEFITS VERSUS BURDENS

Project engineers occasionally object to the imposition of a format requirement for the statement of work on the grounds that it tends to inhibit them in the meaningful expression of their ideas. In addition, a specified format may frequently require a project engineer to devote more time to SOW preparation than he judges is necessary for the clear communication of project requirements. However, if a project engineer has a thorough understanding and knowledge of the objective, purpose, nature and detailed requirements for his project prior to attempting to comply with format requirements, he should be able to write his statement of work in accordance with any format.

Let's look at the nature of the format requirement as specified in AFSCP 800-6; Statement of Work Preparation Guidelines. The pamphlet specifically states that the formats proposed for each type of procurement are nothing more than samples to guide AFSC personnel in the documentation of project requirements and tasks. It additionally advises that each SOW should be tailored to meet the needs of a specific program. Clearly, meaningful and complete statement of work content is more important than format adherence.

There are, however, distinct advantages in pursuing some degree of standardization at the major paragraph level in R&D statements of work. An organized SOW format allows all readers to uniformly relate to the basic project engineer thought pattern in the SOW content. They will be able to readily identify and differentiate between general information, project requirements, and deliverable contract end products/services. In addition, if all the AFSC laboratories utilize the same basic major paragraph level format, then contractors accomplishing or pursuing work with more than one laboratory will have a reduced chance of requirement misinterpretation as a result of widely varying formats. They will be able to write technical proposals that will not require SOW clarifications because project requirements have been masked by format considerations. Finally, a

format requirement helps a project engineer and his SOW writing team avoid the possibility of omitting important requirements or tasks from the body of the document.

FORMAT FOR RESEARCH AND DEVELOPMENT STATEMENTS OF WORK

Statements of work vary from complex R&D systems to statements of performance requirements or objectives for feasibility studies, experimental equipment, data, etc. The general format and headings for research and technology statements of work are as follows:

1.0 Introduction (Objectives).

2.0 Scope .

3.0 General Background (information, constraints, and reference documents).

4.0 Tasks/Technical Requirements.

5.0 Reports, Data, and other Deliverables, Attachments, as appropriate.

6.0 Special considerations.

EXAMPLE - RESEARCH AND DEVELOPMENT STATEMENT OF WORK

The following example should be used by project engineers as a guide in describing technical tasks. For ease of correlation to the format just presented, the SOW element descriptions are numbered to match.

1.0 INTRODUCTION (OBJECTIVE). (The introduction is intended to give a brief overview of the specialty area and describes why this particular new program is being pursued. The overall requirement which needs fulfillment, the present difficulties or deficiencies which do not permit the requirement to be met, and the determinations which must be made to solve the problems, should be outlined briefly, in fully understandable terms. Quite often an understanding of the value of the technical objective can be reinforced by inclusion of an explanation of the payoff that this technical objective will have to future Air Force system capability. In framing the

objective, think clearly on how the results will be used. The stated objective should be consistent with the funds planned and/or with the minimum requirements.)

2.0 SCOPE. (This section provides an overall picture of the desired work in concise form. The scope will outline the various phases of the program and tie down the overall limits of the program in terms of specific technical objectives, time and any special provisions or limitations. It must be consistent with the detailed requirements. This section should also describe in a clean-cut statement the end result desired or what the "product" of the effort should be. Don't overextend the magnitude expected or an overrun may be the result.)

2.1 (Work outside the scope involves new negotiations and may cause increased costs. The manner in which scope is defined will govern the amount of direction that a project engineer can give and that the contractor will accept during the contract's life.)

3.0 GENERAL BACKGROUND. (Include any background information, explanations, or constraints which are necessary in order to understand the requirements. Discuss how the procurement arose; indicate its relationship to previous, concurrent, and future operations, including the threat analysis, and relate details which reveal its purpose and significance. Statements on the importance of the new work may also be included. Techniques which have previously been tried and found ineffective should be included. Frequently it is best to leave the writing of the background to the last. The listing of applicable technical reports resulting from the DDC bibliography search should be entered here. Any such listing in this paragraph is for information only and not contractually obligatory.)

3.1 APPLICABLE DOCUMENT LIST. (All contractually applicable documents must be cited either in the text of the appropriate task or in a separate paragraph entitled "Applicable Documents List." If there were no applicable reports, a comment to this effect should be made on the supplemental sheet to the purchase request but not included in the SOW.)

4.0 TECHNICAL REQUIREMENTS/TASKS. (This paragraph should define the work to be accomplished and indicate the main steps and actions which are required of the contractor to properly conduct the program. These main steps constitute the work phases (recommended approach). The technical leadership provided by the Government in planning and establishing the contractual program appears here. It should not reflect an attitude that this is the only approach to the problem. It should state that this is a suggested method but new or unique ideas supported by available data are acceptable and encouraged. This paragraph also gives known specific phenomena, methods which could contribute to a solution, possible correlation with existing knowledge, operational and installation environments anticipated for the ultimate operational equipment, and such other factors, including all available foreign technology information, as would tend to assure that the contractor would conduct a fully effective program.)

4.1 (The statement of work should express the minimum performance which will satisfy operational requirements. Minimum acceptable requirements are the least possible requirements necessary to assure the item(s) specified will do exactly that which is intended. Requirements must be definite, realistic, and clearly stated so they can be met at a practical cost in money, labor, and raw material. The art of converting requirements to descriptive text, written technical matter, requires a certain degree of skill in the choice of words and utilization of certain terms. Often the

inadvertent misuse of words such as and/or, but, shall, will, may, and other will alter the legal meaning of the document to such an extent that the Government may not receive the required end product/service.)

4.1.1 (Describe the requirement in complete detail not only for legal reasons but also for practical application. It is easy to overlook many details; it is equally easy to be repetitious. Beware of both! For every piece of deliverable hardware, for every report, for every important action, there is not only the what but also the when and the where. If it is necessary to omit a quantity or time and to specify that something shall be done as necessary specify whether the judgement is to be made by the contractor or the Government. Remember that these types of contingent actions have impact on the price. Where expensive services such as technical liaison are to be furnished, do not just say as required. Provide a ceiling on the amount or work out a procedure that will ensure reasonableness and Government control. The number and type of proposals received and adequacy of procing will be greatly dependent upon the content and phraseology used in the technical SOW.)

4.1.2 (The statement of work should be specific as to the end result desired or expected; the conduct of research and development is not the objective in itself. Relevance to military application should be indicated.)

4.1...) (Work statements will be structured and numbered according to the multi-numeric decimal system illustrated in this example.)

4.1.2.2 (The technical requirements and/or work requirements should be arranged in logical order. Care should be exercised to exclude any phraseology that is subject to misinterpretation.)

4.1.2.3 (Work statements should be as definitive as possible such that they may be included in any resultant contract.)

4.2 (If the work encompasses several areas or lends itself to division into tasks, this should be indicated. The essential procedures (that is, theoretical analyses, design, fabrication, checkout, tests, verification, formulation of final recommendations, etc.), with limits on each, constitute the bulk of this paragraph. In some cases, the engineer may wish to indicate the percent of the total effort each phase is to receive. If there are existing specifications with paragraphs that define what you want to have the contractor do in terms of tests, etc., use them (incorporate by reference, as appropriate) rather than compose original paragraphs. Specify those considerations which may guide the contractor in his analysis, design, or experimentation on the designated problem. These should include operational characteristics (if any) or other factors the contractor is expected to consider in performing under the contract.)

4.2.1 (Each task and deliverable end item should be identified to a specific period of performance or delivery date. It is the responsibility of the writer to establish this

requirement as a part of the program management task of the SOW. While the period of performance or delivery schedule may be integrated into each task description in the SOW, a schedule summary is sometimes provided as a separate document so that it can be used as an exhibit to the request for proposal (RFP) and subsequently incorporated in the body of the contract. Delivery schedule may be stated in terms of calendar days elapse time (that is, 223 calendar days after contract award) or by a specific calendar date, that is, 1 May 1973.)

4.2.2 (In statements of work requiring the contractor to perform testing, the test requirements will be clearly and adequately stated and must correlate with the design requirements so that contractor testing responsibilities are defined.)

4.2.2.1 (Where properties of materials are desired, each individual property and/or test should be specified.)

4.2.2.2 (If it is desired to have the contractor choose materials to be evaluated, so state (<u>with limits</u> - so the contract may be priced accordingly) or to make "subject to approval of the Contracting Officer.")

4.2.3 (Consider the necessity of including guidance relative to special technical factors or requirements.)

4.2.3.1 (Qualitative reliability and maintainability requirements may be expressed.)

4.2.3.2 (System safety requirements may be expressed.)

4.2.4 DEFINITIONS. (In many instances, the inclusion of a definition can be avoided if requirements are properly stated. When the meaning of one or more terms must be established, definition should be placed in the SOW. A single definition may appear immediately following the term where used. However, it is often clearer to list one or more definitions in a separate section when the terms are used in many places throughout the document.)

4.3 (Be sure that limits of environment, test durations, combustion pressures, data recording, expansion ratio, mixture ratio, range of particle size, etc., are specified. Criteria governing the number of designs, types of propellants, performance, hardware size, number of tests, etc., and constraints such as budget, environmental producibility and risk levels should be included in the definition of the work to be done by the contractor.)

4.4 COMMIT YOURSELF. (When the burden of definition must be placed on the offeror, clearly impose the requirement in a manner so he understands that he must provide this definition in the proposal (if this is what is wanted) or later on in the contractual program (if this is the intent). Any specific limitation such as "not desired" or "previously tried" techniques should be stated. If there is a primary area with a secondary contributing or limiting area, they both should be defined. Experimental or installation environments (known or anticipated), scientific or technical personnel, other resources should be indicated. When the offeror provides definition or plans, it should be stipulated that these are subject to Air Force approval.)

4.5 (A description should be given of any end item that is the subject of development. It will firmly and clearly define the required work for such tasks as those listed below.

- Review of current literature to establish a basis for further research, analysis, investigation, or experimentation.

- Search for new ideas through investigation of various phenomena.

- Paper or theoretical analysis of ideas in relation to requirements, ultimate use, and trade-off capabilities.

- Computational analysis and formulation of mathematical model.

- Experimentation to evolve methods of instrumentation.

- Derivation of a basic equipment design or experimental assemblies.

- Test and evaluation.)

4.5.1 (Trade names, copyrighted names,or other proprietary names applying exclusively to the product of one company shall not be used unless the item(s) cannot be adequately described otherwise because of being peculiar to one (or a few) companies. In such instances, one and, if possible, several commercial products may be included, followed by the words "or equal" to assure wider competition and that bidding will not be limited to a particular make specified. The same applies to manufacturer's part numbers or drawing numbers for minor parts when it is impractical to specify the exact requirements in the SOW or exhibit. Insofar as practical, the particular

characteristics required shall be included to define "or equal." Before making a reference to any commercial designation, check carefully to be sure there is no military specification or standard covering the item. If necessary to use "or equal," limit it to minor items.)

4.6 (Do not repeat detailed requirements of applicable documents specifications, etc. However, if amplification, modification, or exceptions are required, make specific references to the applicable portion of the documents involved and state the requirement.)

4.7 (If the state-of-the-art is such that one or more specific methods of approach to the solution are to be followed, this section should indicate the desired approach. If no specific approach is primarily warranted and one will be determined on the basis of the selected contractor's technical proposal, this section should include a statement of criteria on which contractor proposal of alternative approaches will be based.)

4.8 SCIENTIFIC AND TECHNICAL INFORMATION (STINFO). (Insert the following, if applicable: "The contractor shall search the existing sources of STINFO to determine the current state-of-the-art to avoid duplication of effort and conserve scientific and technical resources." Ensure that all generated STINFO that has a significant value to the pertinent scientific and technical communities is furnished to DDC.)

5.0 REPORTS, DATA, AND OTHER DELIVERABLES. (Contract data or reporting requirements should not be duplicated in the SOW. DD Form 1423 is the medium for establishing data requirements. The SOW may refer to the DD Form 1423 incorporated in the contract by reference or even to any particular data item for clarifying a requirement. If deliverable hardware is required, it should also be listed in this section as a separate paragraph.)

5.1 (AFSC Regulation 310-1 provides policies and procedures for:

5.1.1 Preparing DD Form 1423, Contract Data Requirements List, which becomes a contract exhibit.

5.1.2 Using DOD Standard DD Forms 1664, Data Item Description, which are contractually incorporated by reference on DD Form 1423 and govern the delivery of all data, other than ASPR requirements in the general or special contract provisions.

5.1.3 Developing, approving, and using program peculiar, or unique, data requirements as well as modifications to capitalize upon contractor internal data in relaxed format. With few exceptions, all deliverable data is directly related to work statement tasks that generate the data; however, nothing in the SOW can call for the delivery of data. Unless specific data requirements are a by-product of the SOW, they will be subject to question and challenge.)

5.2 (If the contractor is to furnish samples, the number and size must be stated. All samples specified must be clearly described as "research samples" when RDT&E funds are used.)

6.0 SPECIAL CONSIDERATIONS. (A paragraph outlining any special interrelationships between the contractor and other agencies or other contractors for use of Government-furnished or loaned property may be devised and added to the SOW as paragraph 6.0. Any other specific directions relative to technical work (not administrative matters) for the contractor to follow should be included here. If a flight test program with USAF aircraft is involved, the contractor's maintenance and

safety-of-flight responsibilities will be outlined; however, be careful not to duplicate any of the special provisions or general provisions of the contract. This paragraph might also provide instructions to the contractor relative to the possible use of Government expertise; for example, the availability of AFML assistance in determining the state-of-the-production-art and the practical availability of new technology.)

6.1 (Spell out carefully all obligations of the Government. If Government-furnished equipment (GFE) is to be provided, state the nature, condition, and time availability of the equipment; also, how it is to be refurbished and restored. If approval actions are to be made by the Government, provide for a time limit. Remember that any provision which takes control of the work away from the contractor, even temporarily, will invite a contingency reserve. Do not build in the need for contingencies.)

6.2 SECURITY. (A DD Form 254, Contract Security Classification Specification, may be developed for procurement actions, based on the specific content of the SOW measured against the master security classification guide for the individual program. The SOW writer should include any security constraints or international aspects that will have a significant effect on performance of the work to be accomplished.)

AMENDMENTS AND REVISIONS TO THE STATEMENT OF WORK

It is not uncommon for statements of work to need modification as a result of content problems identified in the SOW either prior or subsequent to contract award. The modifications fall into two distinct categories: amendments or revisions.

An amendment to a statement of work is normally used for correction of typographical errors and mistakes in grammar and punctuation. It is also used to make additions or deletions of information to improve clarity and minor requirement changes. An amendment does not cause a change in the numerical identifier

of the SOW. It is accomplished on a separate document and requires no change in the form of the basic SOW. As a general rule of thumb, an amendment should be written when the amount of change to information contained in the basic SOW does not exceed 25 percent.

Amendments are identified in numerical sequence. Each successive amendment to the basic SOW, written prior to contract award should incorporate all changes to requirements established in the SOW from the previous amendment. It should also include all unchanged requirements or changes from the previous amendment. When completed, it will supersede any previous amendment in its entirety. The format to be used for amendments is the same as the basic SOW.

If the amendment is required after the contract award, coordination must be accomplished with the contracting officer prior to the preparation of the amendment. This action is necessary to permit the contracting officer to decide upon the best method of preparing and including the required changes in the contract. The contracting officer may determine it to be more feasible to prepare the next successive amendment to cover changes that have transpired since contract award. He may not supersede the previous amendment(s) which are now covered in the contract. In this case, a supersession note at the top of the amendment may not be included. The statement that will be attached to this amendment will read similar to the following: "This amendment forms a part of statement of work AFHRL-C-2468, 1 September 19XX, and amendment 3, dated 20 December 19XX."

Each individual correction contained in the amendment is presented separately and the particular page, paragraph, table, or figure to which the change applies is identified. The imperative form of the verb is used in the amendment to indicate the changes to be made. When paragraphs are deleted from the basic SOW, the remaining paragraphs in the section should not be renumbered. When new requirements are added to the basic SOW by the amendment, they are added in such a way that paragraph renumbering is unnecessary.

Revisions are made to the basic statement of work when the changes involved are of considerable length in relation to the size of the basic SOW or for major format changes. A revision should be made when any combination of major or minor changes total more than 25 percent of the basic SOW.

The 25 percent rule of thumb for revisions also applies when the total amendments made to a particular SOW amount to a 25 percent change. When revisions are made, all requirements should be analyzed and brought up-to-date as far as practicable.

Revisions to an SOW are indicated by the additions of a capital letter following the basic contract numerical identifier, such as, AFHRL-C-2468A. Succeeding revisions should be indicated by the remaining letters of the alphabet in alphabetical sequence. A revision is an issue superseding the previous document in entirety with all pages being identified by the same applicable revision letter.

CONCLUSION

The reader may have noticed that the major paragraph level format recommended in this chapter aligns itself rather closely with the guidelines recommended for planning, organizing, and writing a SOW. If a project engineer can maintain this close relationship between the planning, organizing, writing, and format considerations for his SOW, he may find that the final writing of his statement of work will be a much easier task.

# CHAPTER 6

## REVIEWING THE STATEMENT OF WORK

### INTRODUCTION

If a project engineer has been successful in writing a quality statement of work, then he and his Procurement Contracting Officer (PCO) can substantially enhance their chances of satisfying the R&D project's requirements with a better contract requiring less financial resources and technical effort. In our present inflationary era where the value and amount of R&D funds are decreasing in real terms, project engineers cannot afford to become complacent or indifferent with regard to SOW preparation. The very existence of their projects has become dependent upon their project preparation and management abilities.

Vague and ambiguous SOWs can quite differently cause poor contract performance and a virtually endless continuum of contract management problems. Project goals may never be achieved or successfully pursued regardless of the nature of the technical risk in the project. In those cases where the contract can be carried out to successful completion, the amount of supplementary funds and schedule slippages required to correct SOW deficiencies may be very significant. In order to preclude this type of SOW from being written and used in a contract, it is strongly recommended that the project engineer institute a SOW review procedure that will extend from the day he starts to prepare his SOW to the day when the resultant contractual effort has been completed.

When prospective contractors are writing their technical proposals, they frequently subject them to a rigorous internal review. The proposals are given to company employees only slightly familiar with the proposed project. The employees are asked if they understand the message being communicated in the proposal. They are also asked to review the SOW and determine whether the proposal responds to or deviates from the requirements of the SOW. When gaps are found between the SOW and the company proposal, efforts are initiated to refine the proposal content or add supplementary data to strengthen the proposal. The project engineer is well advised to use the same strategy within his laboratory and procurement organization in order to assure the teamwork approach for both SOW preparation and review.

## REVIEW THE STATEMENT OF WORK WHILE IT IS BEING WRITTEN

It is helpful for the project engineer, who has primary responsibility for formulating the SOW, to routinely evaluate the quality of the work statement as preparation progresses. In any case, he keeps in mind the main criteria needed to judge whether the material in the SOW is correctly included. The following tests of SOW material applicability have been mentioned in numerous places in the pamphlet. They are repeated here for ease of location and mainly for emphasis. They are:

a. Does this information tell the contractor what he is required to do?

b. Is this information necessary to assist the contractor in understanding what is required of him?

c. Will the contractor and the Air Force be able to negotiate reasonable pricing parameters for these items (tasks), services, etc.?

d. Will the tasks, when accomplished, produce results consistent with project objectives?

## CHECKLIST FOR STATEMENT OF WORK REVIEW

A practical means of reviewing the SOW is to ask knowledgeable and experienced associates to read and critique the SOW prior to submission for approval. When fellow project engineers, functional experts, and other procurement representatives are requested to provide their comments, it is often possible to discover ambiguities, inconsistencies, and other deficiencies before seeking approval in the RFP process and, more importantly, before transmittal to prospective sources. The main test is always "Is it clear?," and cold readings by others in the review process point up those aspects not immediately discernible to authors.

The following checklist is recommended for use by all personnel reviewing a SOW. It is an extensive list but it is, by no means, complete. It should be tailored or expanded to meet the needs of the specific SOW undergoing the review process. The checklist may enable all SOW reviewers to keep foremost in their minds the salient feature of the review process objectives while the SOW is being prepared or prior to its inclusion into the RFP.

a. Have the required project objectives and desired results been clearly and specifically described?

b. Has adequate background information been provided that would be helpful to a clear understanding of the requirements and how they evolved?

c. Have technical considerations such as any known specific phenomena or techniques been clearly presented?

d. Does the SOW include a detailed description of the technical requirements and subordinate tasks?

e. Is the required technical effort feasible for contractor performance by reason of the SOW language?

f. Does the state-of-the-art support the prescribed goals as being realistic?

g. Has the risk of performance been minimized to the maximum practical extent by the elimination, whenever possible, of items or considerations not absolutely needed for the successful accomplishment of the project? Have "nice to have" or redundant requirements been eliminated from the "essential" items?

h. Is the SOW sufficiently specific to permit both the project engineer and any prospective contractor to make a list of the manpower, special facilities, equipment, subcontract or consultant resources (whichever are applicable) needed to accomplish the project?

i. Does the SOW content permit prospective contractors to prepare, as required, estimated costs for each task or performance area?

j. Is general information separated from technical requirements/tasks so that background information, suggested procedures, and the like are clearly distinguishable from contractor responsibilities?

k. Are the specific duties of the contractor stated in such a way that he knows what is required and the government agent who signs the acceptance report can tell whether the contractor complied?

l. Are contractor requirements clearly and appropriately stated including standards which make it possible for both government and contractor personnel to measure performance?

m. Have the appropriate milestones been introduced into the SOW for all tasks that require a government review and approval or acceptance/rejection decision before the contractor proceeds to accomplish additional effort?

n. Are the proper reference documents shown? Are they pertinent to the task? Fully or partially? Are they properly cited in the SOW?

o. Are any military specifications or standards applicable? In whole or in part? If so, are they properly cited? Has the latest available revision or issue of each appropriate document been quoted?

p. Have reporting requirements and any other deliverables (data, test support, experimental hardware, prototypes, etc.) been included in the SOW?

q. Is there a date for each contractor delivery requirement? If "elapse time" is used, does it specify calendar days or workdays? Are the proper delivery requirements shown?

r. Have the type and quantity of reports (technical, financial, progress, etc.) required for delivery been specifically described and specified?

s. Have all data requirements been reviewed to ensure compatibility with the data requirements specified on the DD Form 1423? Have all extraneous data requirements been eliminated?

t. Have the Armed Services Procurement Regulations (ASPR) requirements relative to the contract line-subline identification been followed?

u. Has the SOW been written as specifically as practicable while providing the contractor the necessary flexibility consistent with project needs?

v. Has the role and responsibility of the project engineer been clearly identified? Have special considerations been properly documented?

## REVIEWING THE STATEMENTS OF WORK IN ACTIVE CONTRACTS

The project engineer's responsibility to review a SOW for clarity, coherency, and completeness does not stop at the time of contract award. A statement of work is not a static document which is tailored to fit the needs of a specific R&D project prior to the award of contract into a fully executed contract. The need to monitor the relevancy of SOW content to project objectives continues throughout the life of a contract. The technical requirements, tasks and contract deliverables may change as a result of contractual progress or lack thereof. Requirements may become antiquated and need a timely updating. They may possibly become unattainable and require modification to allow the pursuit of alternate technical requirements that can possibly be achieved without jeopardizing the project's objectives. The technological threat to which the project is responding may be altered and necessitate a significant realignment of the entire SOW. Weaknesses in content, undetected prior to contract award, can materialize as the contractual effort is being pursued and result in contract management problems which call for immediate attention.

The list of things that can go wrong with a SOW in an R&D contract is virtually boundless. As mentioned in Chapter 1, research and development is intrinsically uncertain and highly susceptible to change. Consequently, the SOWs written for such projects should be closely scrutinized to assure a continually relevant content in an ever-changing environment. The project engineer always needs to be current in contract status. Amendments or revisions, as appropriate, may have to be prepared to correct existing SOW deficiencies.

Additional funds may be required before a contractor will accept and pursue SOW changes. As a result, the project engineer must work in close coordination with his Procurement Contracting Officer in order to assure that all SOW changes are accomplished in an integrated orderly manner. The alternative approach, unilateral SOW changes in technical or delivery requirements, can precipitate a range of problems from cost overruns to legal litigations. For these reasons, procurement regulations specifically require that all changes be initiated by the project engineer through his PCO to the contractor concerned. The PCO is the only government official possessing the authority to make such changes.

## REVIEWING DATA REQUIREMENTS AND TECHNICAL REPORTS

The contract data requirements included in R&D SOWs have historically not received sufficient project engineer attention during the formulation process and the negotiation of the resulting contract. They might not generate any concern until the contractor satisfies the requirement by delivery. Unfortunately, if the required data have not been prepared and submitted in an acceptable manner, contract resources may have been wasted. Attempts to correct any deficiencies may cause schedule slippages, contractor protests, or possibly increased contract costs.

Frequently, project engineers and personnel supporting the effort just identify their information requirements. They may be relying too heavily on the laboratory data specialist to select the appropriate Data Item Descriptions (DD Form 1664) and consolidate them on the consolidated Data Requirements List (DD Form 1423). The questions concerning what data is actually needed, why it is needed, what constitutes acceptable contractor submitted data, and what is the data cost impact on the technical portion of his project, really do not receive proper project engineer emphasis prior to contract award. The overall contract management responsibility lies with the project engineer. However, when it comes to data management, he may have inadvertently avoided the issue. The data manager or the PCO is left with the task of resolving the data problem on active contracts. This delegation, however, does not relieve the project engineer of his data management responsibility.

There are very high costs associated with the generation and preparation of contractor submitted data. Consequently, it is in the best interests of the project engineer to develop and implement a procedure which will objectively challenge all data requirements required in his SOW. He can then be assured that the contractor will provide only essential data in support of his project.

### Checklist for Challenging Data Requirements.

The following checklist has been prepared in order to help the project engineer determine that only essential data requirements are introduced and satisfied in his contract. The assistance of laboratory data management personnel should be solicited in order to ascertain the procedures for implementing the checklist. It will be noticed that the checklist is divided into three phases that extend across the entire life of the project.

a. Precontract Phase (from the start of the SOW formulation process to the submission of the completed Purchase Request Package to Procurement). A comprehensive challenge of data requirements during this phase provides the project engineer with the maximum opportunity for data cost avoidance. The first ten questions that will now be presented should be answered by all personnel identifying data requirements. Questions 11 through 13 should be discussed with the data management and procurement personnel.

(1) What specific data is needed?

(2) Why is it needed?

(3) What will actually be received when a data item is delivered by the contractor?

(4) How will the data be used?

(5) What is the estimated value/worth of the data with respect to project accomplishment?

(6) How much does the data cost?

(7) Are there alternate ways of obtaining the same information? Have they been evaluated? (The information may already be available within the Government.)

(8) Are potential contractors being encouraged to propose using their internal formats for presenting data when their formats adequately display the information required on equivalent government formats? The cost savings can be substantial.

(9) What would be the impact if the data requirements were deleted?

(10) Is the need for the data such that it justifies the price to be paid therefor?

(11) Are deferred ordering techniques being utilized for data item descriptions satisfying actual requirements that cannot be economically determined prior to contract award?

(12) Is deferred delivery being prescribed in contracts where data is to be delivered but no delivery schedule has been formulated?

(13) Is deferred requisitioning being employed in contracts which can specify the format, range, and kinds of data to be delivered, via requisition, to the Government along with the ordering conditions and pricing terms?

b. Technical Proposal Evaluation - Negotiation of Contract Phase. This phase of the procurement process is the last opportunity a project engineer has to effectively avoid the cost of excessive data requirements. It will require a close working relationship between the project engineer and project supporting personnel (technical, data management and procurement). The objective is to assure contractor's data proposal reflects a compliance with the DD Form 1423 data requirements and exhibits an acceptable data quantity, quality, estimated cost, and schedule.

(1) Are the contractor sata proposals adequately proced out?

(2) Do the contractor estimated data prices justify the retention, modification, or deletion of cited data requirements?

(3) Is the use of contractor formats as a substitute for government formats being considered during the negotiation?

c. Active Contract Phase. During this phase, the project engineer needs to review the data as received versus the data requested. The data's intended use should be studied to determine its contribution to the project. The answers to the questions suggested below may provide a project engineer with a better insight into the data requirements for follow-on efforts or projects of a similar nature.

(1) Is the data delivered by the contract received in accordance with the contract's schedule and data requirement specifications?

(2) Is the data, as delivered, useful in satisfying the cited data requirement?

(3) How is the data actually being used?

(4) Is the data, as delivered, worth the price paid for it?

(5) Are data requirements being removed from contracts when they cease to be valid requirements?

Technical Reports.

Technical reports are generally one of the most important data requirements that a project engineer will need in order to measure contractor performance against the SOW requirements. In some cases, the only products delivered by the contractor on an R&D effort may be technical reports. As a result, the project engineer may want to specifically address the format and content requirements for technical reports while the SOW is being written. The laboratory personnel serving as in-house technical report editors may provide invaluable assistance in this area.

The project engineer may want to specify a format for the technical report. It will serve two possible purposes. It will provide contractors with report construction guidance and minimize the need for a contractor rewrite of the report. Secondly, it may also help the project engineer in his evaluation of contract compliance. For cases where the technical report must satisfy the need of more than one classification of reader, the body of the report should be limited to the main ideas with appendices used for detailed supporting data. An abstract may be appropriate.

Regardless of the construction that may be specified for the technical report, the content should contain the following information:

a. Subject and Purpose of the Report;

b. The USAF interest in the subject matter;

c. Project Methods/Procedures and Results;

d. Contractor Conclusions; and

e. Contractor Recommendations.

# CHAPTER 7

## STATEMENT OF WORK PITFALLS AND REMEDIES

### INTRODUCTION

In Chapter 6 of this pamphlet, recommended checklists were presented to assist a project engineer in conducting a review of his statement of work. However, project engineer knowledge of review techniques for his SOW is a separate and distinct issue from possessing the ability to thoroughly review the SOW content. The government personnel helping the project engineer to write and review the SOW may only be contributing from their own functional area perspectives. As a result, the determination of whether or not the SOW communicates (in a clear, coherent, and understandable manner) the technical tasks to be performed may be difficult to evaluate.

One of the main points stressed in this handbook is that the SOW should be written so as to preclude the possibility of more than one interpretation of content. The question of contractor interpretation of SOW requirements must be specifically addressed in the review. As a result, the project engineer should conduct a special review to identify all possible contractor interpretations of content and their impact on efficient project accomplishment. It should always be assumed that, given more than one possible SOW interpretation, a contractor will select the one that best suits his objectives.

It is the purpose of this chapter to present some general examples of SOW pitfalls followed by examples of potential pitfalls that can be seen in some real world R&D SOW paragraphs, that is, possible contractor interpretations and the consequence thereof. A suggested approach to remedying pitfalls will also be presented.

### GENERAL DISCUSSION OF SOW PITFALLS

The chief trouble spots in procurement documents are indefinite, unrealistic, restrictive, inconsistent, antiquated and unenforceable requirements. They appear in statements of work quite frequently because of carelessness, or just plain lack of common sense. In addition to contributing to potential project failure, they often result in ill feelings, extra costs, and occasionally,

contractor bankruptcy. Below are general examples to illustrate the problems that can be encountered:

a. Indefinite Requirements. Those requirements stated in such an incomplete or ambiguous manner that numerous interpretations are possible. The following are 12 examples of indefinite requirements. They have been numbered and capitalized for each identification. (For illustration purposes only, the item described is a procurement document for sugar cane molasses.)

> The molasses should be prepared in the PROPER (1) manner and shall be as FREE FROM IMPURITIES AS (2) BEST COMMERCIAL PRACTICES (3) make POSSIBLE (4). The molasses shall be a product obtained in the manufacture of cane sugar without EXCESSIVE (5) use of sulphur or other bleaching agent. The finished product shall be of GOOD FLAVOR (6) CHARACTERISTIC (7) of HIGH QUALITY (8) sugar cane molasses free from UNDESIRABLE (9) taste and odor; shall be REASONABLY (10) clear; shall contain no EXCESSIVE (11) sediment; and shall be PRACTICALLY FREE (12) from dirt, grit, or other matter.

b. Unrealistic Requirements. Those requirements that are either impossible to meet or which raise the price of the item to an uneconomical level. Inclusion of such requirements is one of industry's chief criticism of Government procurement documents. An example of this type of problem would be a procurement document which is for peanuts (roasted, salted) and which established a minimum requirement of a 27-inch vacuum for the container to transport the peanuts. Commercial equipment can normally "pull" only 25 inches. Few, if any, manufacturers possess the type of equipment to meet the requirement. To equip machines to provide the extra 2 inches would require excessive special equipment that contractors would not need after military orders were completed. This requirement is, therefore, unrealistic and unduly increases the cost of the product to the Government.

c. Restrictive Performance Requirements. Those requirements that unncessarily limit the methods of performance. This requirement may preclude the use of

alternative methods which are better and sometimes less costly than those specified. An example of this type problem would be a requirement in a procurement document stating "the glue used shall be an animal glue conforming to Federal Specification MMM-A-100C." This requirement is restrictive in that it does not permit the use of synthetic glue which would afford a bond equal to or superior to that obtained by the use of animal glue. Use of synthetic glue should be permitted or the reference to type of glue should be deleted and a performance test substituted.

d. Inconsistent Requirements. These requirements in a procurement document mean the presence of two or more requirements that are mutally exclusive. That is, if the contractor meets one of them, he cannot meet the other. An example which illustrates this type problem was encountered in a military specification for a service cap. The specification contained one provision stating "the braid shall be stitched with its bottom edge located not more than 1/16 inch above the center of the 1-inch band." If this is done, the braid comes right down to the bottom edge of the band after the latter is folded under along its center line. This requirement was in conflict with another provision of the same specification which required "the braid be located so that its bottom edge is 3/16 inch above the bottom of the band in the finished cap." (The above inconsistency was subsequently corrected by deleting the requirement that the braid be stitched to the center of the 1-inch band.)

e. Antiquated Requirements. Those characteristics that have been left behind by the march of technological progress. In addition, they frequently get introduced as a result of a blind application of the "scissors and scotch tape" approach to SOW preparation. Before any specification is referenced, it should be reexamined to ascertain if it is up-to-date. An old specification for coconut (prepared) was one of a group of specifications written over a decade ago and used long after conditions had changed. Since the time this specification was written, numerous processes, such as frying (desiccating), formerly performed in this country are now being performed in the tropical areas where the product is grown. This procedure eliminates the need for differentiating between the types currently specified; namely, all domestic processing and partially domestic processing since only one type can presently be procured.

Differences in manufacturing techniques have also arisen, making the size distinctions established in the specification currently meaningless. Moreover, techniques have been adopted by the trade for mostening the desiccated coconut, utilizing propylene glycol which also serves as a mold inhibitor, thus extending the storage life of the product considerably. Such practices were not reflected in the old specification.

f. Unenforceable Requirements. Those requirements for which it is difficult or impossible to perform or to conduct inspection. As an example, a specification for sauce (Worchestershire) established a requirement that the sauce be well cooked and thoroughly ripened in wood for not less than 60 days. Since no end-product test has been established to differentiate between a product which has not been ripened, or ripened for a shorter period of time, as against a product which has been ripened for the specified period, an inspector is obliged either to witness the aging process or accept the contractor's certificate that he has complied. The true extent of this problem can be fully appreciated when the 60-day aging period is compared with the shorter period of time generally allowed for procurement and delivery of the product.

## PITFALLS IN R&D STATEMENTS OF WORK

The following is a sample of paragraphs taken from R&D SOWs that were actually incorporated into contracts. They all contain potential pitfalls that can affect project resources and contractor performance. After each sample paragraph, a discussion of the potential pitfall will be presented. The objective is to provide project engineers with concrete examples of how to critically review an SOW for pitfalls.

### Case Example 1

> The contractor shall establish physical properties and strength characteristics of the racks and cabinets which house the components. This may require discussions and visits with the manufacturers, that is, Lenkurt and WECO, and may be subject to proprietary agreements.

### Discussion

While it may be appropriate for a project engineer to allow a contractor to establish physical properties and performance characteristics, should there not be a

constraint introduced that the properties and characteristics are subject to government review and approval? In the second sentence, the word "may" is used twice and two questions come to mind. First, how does the contractor price out in his proposal the travel expenses associated with possible manufacturer visits or should he not do so because the word "may" connotes an optional SOW requirement? Second, what is the project engineer intent of "and may be subject to proprietary agreements?" If the project engineer is attempting to delegate a proprietary information situation to the contractor, his project may be heading for a serious cost increase and potential legal problems. In any case, the wording of the second sentence is such that a contractor can interpret it as an optional requirement and consequently ignore it. "May" means optional.

Case Example 2

For purposes of scoping the level-of-effort, it is assumed that six platforms will be analyzed using the computer model.

Discussion

How can a contractor scope a level of effort on an assumption? The requirement should be specific; a definite number of platforms should be subject of the computer model analysis.

Case Example 3

The adequacy of the cabinets or racks to survive the shock motions will be determined by the analysis; however, the structural and functional survivability of the equipment will be demonstrated later by testing under another contract.

Discussion

The word "adequacy" has no specific meaning. In addition, what shock motions (is it a level or a range) must be survived? This question is not answered in the parent SOW. Should the project engineer separate the issue of cabinet or rack survivability from the equipment's structural and functional survivability? Who is at fault if the equipment "fails" when mounted on the racks or installed in the cabinets? The contractor who assessed the rack/cabinet suvivability, the equipment manufacturer, or

the project engineer who may have neglected to allow for a possible interrelationship of equipment and rack/cabinet survivability?

Case Example 4

The contractor shall specify the test method to be used.

Discussion

Is a government review/approval action needed for the task?

Case Example 5

The government will provide environment for each building and building location, which shall be reviewed by the contractor.

Discussion

What is specifically meant by the word "environment"? What alternatives does a contractor have if he doesn't agree with the "environment" after the government has provided it?

Case Example 6

The transceiver electronics will include circuitry necessary to exhibit the ability to handle high rate asynchronous data.

Discussion

What does the technical jargon "high rate" mean? Can high rate asynchronous data be given a specific quantitative value or range? What will the government accept as "high rate"?

Case Example 7

The transmitter and receiver electronics will be fabricated and delivered in physically separate packages. The transceiver electronics is to be packaged as small and as rugged as possible, consistent with standard fabrication techniques. It is desired to maintain ease of servicing, reliability, performance and low cost, in reasonably small, rugged packages.

Discussion

Just how important of a technical requirement is the issue of the size and durability of packaging? Is it a design goal? If so, how crucial is it? How much time and resources should a contract dedicate to it? What is meant by "standard fabrication techniques"? Will they suffice for this project?

Case Example 8

All contract residuals will also be delivered to the laboratory. Acceptance tests will be made at the systems contractor's facility. Support equipment must be specified early to both the Air Force and the systems contractor.

Discussion

What is the relationship between sentences in this paragraph? Should they not be made separate paragraphs? What will receive acceptance testing? Clearly not the contract residuals.

Case Example 9

SCOPE: This program includes work to be performed at both the contractor's plant and at Air Force _____ Laboratory facilities. The effort shall specifically include the work described in paragraph 4.0 Technical Requirements/Tasks (and may include other related work as required to meet the overall contract requirements provided that such related work is within the requirements and resource limitations of the contract).

Discussion

What is the project engineer intent for the portion of the paragraph in parenthesis? The contractor can ignore it because may means optional. If the other related work actually becomes necessary, will the contractor contend it is outside the scope of the contract and insist on supplementary funding or renegotiation? The paragraph appears to imply that the effort has no definite scope. If this is true, is it wise to go out on contract at this time with a scope of such a nature?

Case Example 10

Technical Requirements - Analysis, evaluation and investigation in the technology of offensive gun-fire control systems are required. Although the effort required is primarily reduction, analysis, and interpretation of test data, (some effort may be required in investigations in areas such as) cross-wind ballistics, kinematic prediction, closed-loop trainable gun concepts, electro-optical and infrared trackers, bullet tracking concepts, and system mechanizations. Thus two types of tasks are required - those dealing with evaluation support (some of which will require quick response), and those dealing with investigations of the state-of-the-art of gun fire control systems.

Discussion

In sentence two, there is a listing of very specific areas for contractor investigation. However, the expression in parenthesis is vague and may be interpreted by the contractor as non-mandatory. Is this really what the project engineer intended? The second sentence should be specially scoped and made mandatory. An alternative would be to rewrite the sentence and specify that the investigations are a separate option for the effort. Then the contractor could write a specific technical and cost proposal for the option and the project engineer could elect to include or delete the option from the contract.

Case Example 11

No reliability testing program need be undertaken as a part of this program. However, an effort should be made to build hardware that will demonstrate tracking and pointing under laboratory conditions for reasonable periods of time without equipment failure.

Discussion

The paragraph tells the contractor that no formal reliability testing program is required for the project. However, what constitutes "reasonable periods of time without equipment failure"? This expression should be clarified or deleted. Otherwise, how can contractor compliance be measured?

Case Example 12

In the conduct of the design and installation of the pallets; equipment, antennas, and associated cabling a system safety analysis shall be performed and documented. These system safety studies will be based on sound, practical engineering judgment, experience and available data. No complete system safety program will be undertaken as part of this evaluation. The prime objectives of the study are to minimize unintentional catastrophic accidents causing physical harm to uninvolved bystanders or the flight crew. Paragraph 5.8.2.1 of MIL-STD-882 contains a list of possible hazards that should be considered.

Discussion

Systems safety is too important of an operational USAF concern to be so vague about. Has the project engineer properly addressed the issue by requiring that safety studies be based on sound practical engineering judgment and experience? This requirement is too abstract and provides the contractor virtually no guidance whatsoever. In addition, what is an "unintentional catastrophic accident" and how far does the envelope of "uninvolved bystanders" extend? Finally, there is no way to measure whether or not a contractor has considered the potential hazard in MIL-STD-882. Is hazard consideration a contractor intellectual process or a specific contractor activity? The intent is very ambiguous. In summary, the project engineer may not have said what he means in this paragraph and contractor performance may be impossible as a result.

Case Example 13

SCHEDULING: Scheduling of calibration and installation services is uncertain at this time due to the nature of the field test. Installation and field test of the system at Cloudcroft, New Mexico will occur when the schedule of operations at the Electro-Optical Surveillance Research Site permits. It is anticipated that this will not occur before 1 February 1973 or after 30 June 1973. Calibration of the system at the contractor's facility shall occur immediately before the field test.

Installation and field test of the system at the Electro-Optical Surveillance Research facility requires eight man weeks of contractor effort at the site. The contractor will be notified at least 15 days in advance of the start of this effort.

Discussion

What are the resource implications of tieing up a contractor's technical service test personnel for a test program with such an uncertain schedule? The contractor may charge the government for the opportunity cost associated with holding his test personnel on a 15-day "alert" status.

Case Example 14

The contractor shall supply an FAA Certified DC9-30F type aircraft and FAA Certified crew. A minimum of 90 flight hours shall be supplied with at least half of those required for on station tests.

Discussion

What is meant by the word "supply" in the first sentence? Is the contractor to buy, lease, or provision an FAA Certified DC9-30F type aircraft and FAA Certified crew? The most reasonable intent appears to be the leasing of an aircraft and the hiring of an aircrew. Has the cheaper alternative been pursued, that is, the use of a USAF test aircraft and aircrew?

Case Example 15

The contractor shall consider the flight test requirements and objectives for flight testing the Radiant system as outlined in the Test Plan generated by the 8795th Test Wing.

The contractor shall consider all system configuration requirements of the Radiant System and associated equipment required for the flight test. Attached to this statement of work is an equipment list, including each individual unit's size, weight, and power requirements and installation drawings made by the XYZ Corporation.

The antenna configuration requires two E/F band omni antennas to be mounted underneath the fuselage. A separation of 15 feet or better is acceptable.

The contractor shall consider all logistics required to assure proper and timely test support with the Podunk Air Base and the FAA. Most flights will occur after 10 p.m. and last for 3 to 4 hours five days a week and possibly on weekends.

The contractor shall consider doing data reduction and writing a flight test report if the 8795th is unable to support this effort. This will require several trips to Podunk and meetings with the 8795th people who had been involved in the data analysis to completely understand what is required.

Discussion

As a result of these SOW paragraphs, the contractor shall clearly be required to consider a large number of tasks. But, what is meant by "consider", is consideration enough, and how does the project engineer propose to measure the contractor's ability to "consider"? If contractor performance is mandatory, the project engineer should specifically say so. If he waits until after contract award, the probability of project failure and legal litigations due to semantics will be exceptionally high. One final point. What does the project engineer really mean by the word "logistics" in the fourth paragraph? For what specifically is he asking?

Case Example 16

a. Provide analysis and evaluation support to Laboratory A in areas associated with gun fire control. This support will be provided at the request of the Laboratory A in areas which may include but will not be limited to the following:

(1) Aid in the planning and execution of flight tests such as the impending tests of the ATS and the comparative gunsight evaluation flight test.

(2) Provide data reduction, analysis, and interpretation of flight test data.

(3) Assist Laboratory A in evaluation of the design and implementation of experimental target tracking systems such as the Augmented Tracker System (ATS) in technical areas where in-house expertise is not available.

(4) Provide support in the generation and validation of software for ballistics and kinematic prediction when not available from Laboratory A in-house analysis.

(5) Aid in establishing requirements for ballistics efforts applicable to gun fire control system design. Laboratory A will submit the requirements to Laboratory B for resolution.

(6) Provide support for evaluation of unique problems as assigned by Laboratory A, such support being limited to constraints imposed by time and fiscal resources.

b. Perform investigations and experiments in gun fire control as assigned by Laboratory A in the areas listed above. Tasks under this item will be conducted as time permits, since paragraph a is to be considered as the major task under this contract.

Discussion

The paragraphs presented in this last case example are possibly a good illustration of inconsistent SOW requirements compounded by the presence of very permissive loopholes. Paragraph b informs the contractor to consider paragraph a as the major contractual task. If this is the case, why is the word

"may" used in the second sentence of paragraph a? Should the word "shall" be substituted in place of "may"? Now let's take a look at the possible reasons for including the expression "but will not be limited to". Was it the project engineer's intention to include the expression in order to stimulate the introduction of the contractor's creative effort into the contract? Alternatively, was "but not limited to" used to provide the project engineer a loophole to compensate for the fact that he cannot identify all the tasks that need to be pursued by the contractor? Will the contractor consider the expression as the imposition of a requirement that allows the project engineer to add tasks during the contract performance without the necessity of receiving contractor concurrence? This question may be a serious concern for a contractor if the contract awarded to him is of the fixed price type. Contractor objections may not be very strong if the contract contemplated is the cost plus type. As a matter of fact, a contractor can turn the expression "but not limited to" around to his own advantage. He may try to interpret into the expression the prerogative to introduce additional tasks at his own discretion without government approval. The dangers of using such language in a SOW should, by this point, be rather obvious. Clearly the project engineer, the contractor, or both parties can be hurt by such phrasing. But, more important, it can almost be guaranteed that the project will definitely suffer the consequences.

REMEDIES

The reader may feel that the discussions of the sixteen case examples just presented may be a bit extreme. But, SOW misinterpretations generate extreme positions between a project engineer and his contractor during the life of a contract. Very drastic project consequences do result.

The culpability for SOW misinterpretations and the consequences thereof cannot always be assigned to the contractor. The project engineer may be his own worst project enemy. His pencil may be leading his mind while he is writing the SOW. Unless he can become his own worst critic with regard to his SOW and the meaning of its content, he may experience problem after problem with his R&D contract. What remedies can he pursue prior to contract award and completely avoid the problem?

The following guidance is proposed to assist a project engineer in his efforts to avoid pitfalls from being incorporated into his contract:

a. Be completely knowledgeable about all of the aspects of your project with specific attention being given to what you want to accomplish in your SOW.

b. Write what you mean and mean what you write. Don't let semantics kill your project!

c. Never assume that the contractor understanding of the real meaning of SOW requirements can be relied upon to circumvent pitfalls in your SOW.

d. Be your own worst devil's advocate. Make a deliberate effort to locate and correct any conceivable misinterpretation or pitfall in your SOW before it is incorporated into the RFP.

e. Actively encourage all preparation and review participants to give your SOW a thorough, critical review before it is sent to prospective contractors for technical proposal consideration/preparation.

f. Assume a contractor's perspective and re-read your statement of work from that viewpoint. Assess the probability of semantic difficulties and pitfall occurrence and their possible impact on project accomplishment. Integrate the results of this evaluation into the output from the preceding two paragraphs.

g. Never be hesitant to revise your SOW prior to contract award. It is better to be active in anticipation of problems than reactive as a result of problems.

h. Establish an SOW pitfall paragraph file from your own experience and those of co-workers. Document the pitfall and its impact on previous contractual efforts. Then use this folder as a guide when you are trying to detect, correct, and avoid pitfalls on all future efforts.

i. Don't loose sight of the facts that:

(1) Contractors may take a literal interpretation of SOW content, and

(2) Given a choice of possible SOW interpretations, a contractor will normally lean toward selecting the interpretation that gives him the maximum possible advantage.

# CHAPTER 8

# THE LEGAL IMPLICATIONS OF THE STATEMENT OF WORK

## INTRODUCTION

This chapter covers in moderate detail the more important legal aspects of specifications/statements of work and their impact on government. It is extracted from Chapter 8, Specifications and Statements of Work of the 3rd Edition of Government Contract Law published by the Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson Air Force Base, Ohio. The purpose of incorporating this material into the pamphlet is to provide a project engineer with a sample of the ways in which the legal community can interpret SOW requirements and the rules pertaining to SOW or specification interpretation.

The work statement, specifications, drawings, and item description formulate the very heart of any procurement. Whether or not a contract will be successfully performed is quite often determined, not at the time the contract is negotiated or the award is made, but rather at the time the purchase or performance description is written. The need for clarity and preciseness of expression is perhaps greater in contracts than in any other form of communication. The extent to which this is or is not accomplished will have a direct bearing on the ultimate outcome of a contract. The greatest care, therefore, is required in formulating descriptions of desired products or services. A job well done results in savings in time, money, effort and administrative headaches.

## DEFINITION OF SPECIFICATIONS

Before any invitation for bids or request for proposals can be used or any contract entered into, it is necessary to define the item or service that is to be the subject of the invitation, proposal or contract. The definitive or descriptive words identifying the subject matter are called specifications. Identification of the subject matter is the heart of each procurement and it is the basis upon which bids are made, proposals offered, negotiations concluded and contracts entered. The use of specifications accomplishes two purposes; (1) the specifications of requirements for an item, material, process or service, and its preservation, packaging, packing and marking; and (2) the establishment of criteria by which the government can determine whether or not contract requirements have been met.

## SPECIFICATION CATEGORIES

a. Minimum Acceptable Description. The minimum acceptable purchase description is the identification of a requirement by use of a brand name followed by the words "or equal." This is used only as a last resort when a more detailed description cannot be made available in the time for the procurement at hand, and, when more than one brand is indicated. The words "or equal" are not added when only a particular sole source producer will meet the essential needs of the government.

b. Design Specification. A design specification spells out, in detail, the materials to be used, their sizes and shapes, and how the item is to be fabricated and built. It provides a completely defined item, capable of manufacture by a competent manufacturer in the industry.

c. Performance Specification. Performance specifications express requirements in such terms as capacity, function, or operation of equipments. In this type of specification the details of design, fabrication, and internal structure are left to the option of the contractor, except that certain features or parts may specifically be required.

d. Mixed Specification. Rarely does the government use a pure form of either type of specification. Practically speaking, rarely is a specification either a 100 percent design specification on one hand, or completely a performance specification on the other. Actually, nearly every specification contains some elements of both types. Characterization of a specification as "design" or "performance," therefore, merely reflects which category predominates. Whatever kind of specification may be used in a procurement, including plans, drawings, or purchase descriptions, it is made available to all potential suppliers. This procedure is an important element in the basic specification policy of the government.

## SPECIFICATIONS POLICY

Department of Defense specifications policy is twofold: (1) to state only actual minimum need and (2) to describe need so as to stimulate maximum competition. The first precept seems self-explanatory. It means that the specification must describe what is needed, not what may be desired. The second precept is to use the kind of specification which will generate maximum competition. There are occasions when the use of a design specification will accomplish this result as, for example, where the item was developed for the government and can be

exactly reproduced by any capable manufacturer without further development. On other occasions, the use of performance specifications may better assure competition being obtained as, for example, where the government requirement can be met by any one of a number of commercially designed and available products. But, as we noted earlier, there are some instances when competition is just not available. An example would be where only one source exists.

Some products, such as specialized military electronic equipment, are not available on the commercial market. Such equipment is especially developed and designed for military use, frequently a time-consuming process. Thereafter, when the government wishes to buy such equipment in quantity, a design specification is used to tell prospective contractors precisely how the item should be made. This makes it possible to avoid duplication of development time, theoretically permits wide competition by firms which do not have the scientific or engineering staffs to do the development, and results in the delivery to the government of relatively standardized equipment from various suppliers.

On the other hand, many items of equipment, such as tractors, earth-moving equipment, laundry equipment, etc., are available on the commercial market. Such items are commercially designed and each manufacturer's design differs markedly from his competitor's. Each manufacturer is tooled up to make equipment to his own design and it would be very expensive to require him to construct equipment to some competitor's or to government design. In these cases, the government uses performance specifications so that competition can be obtained from every firm which regularly makes a suitable commercial product. Such a specification fosters competition and avoids the favoritism which would occur by the adoption of one company's design or a government design which was more nearly like the design of one company than of others. Such a specification also avoids special retooling and production starting costs and, hence, results in lower prices to the government.

Performance specifications are frequently used when no suitable commercial item is available and when there is no standardized government design. In such cases, where, in the opinion of the buying activity, the design problem is well within the capabilities of a number of competent firms having design staffs, purchase will be made against a performance specification and the design details left to the contractor. In this way, it is possible to get competition for items of specialized military usage, but such competition is necessarily

confined to firms which are competent to design and build equipment meeting the military performance requirement. It is also obvious that research and development contracts are performed against what are basically performance specifications.

PRINCIPLES RELATING TO SPECIFICATIONS

a. Contract Must Be Read In Its Entirety. It is a basic tenet of law that a contract must be read as a whole, and in its entirety. It is equally elementary that meaning must, if possible, be given to all language employed. An accepted rule of interpretation is that no word in a contract is to be rejected or treated as a redundancy, or as meaningless, if any meaning which is reasonable and consistent with the other parts can be given to it, or if the contract is capable of being construed with the word or words left in.

Thus, in determining the responsibilities of the contracting parties, and the performance that may be demanded of a contractor, a review solely of the "statement of work" or item description is not sufficient. In accordance with this rule, all parts of the contract should be read and considered in determining what is required.

"All parts of the contract" includes not only the contract document itself, but also matters referenced or incorporated by reference. This, of course, includes any referenced specifications and drawings even if they are not recited "in toto" in the contract document or appended thereto.

b. Right to Requ. e Compliance. Generally, a contract party has the right to strict compliance with the specifications by the other party. Therefore, a contractor who deviates from the specifications as written does so at his peril.

However, where the government, as a result of mininterpretation of the provisions of the contract, requires a contractor to perform work not called for under its terms, the order to perform is a "change order" entitling the contractor to an equitable adjustment in price in accordance with the "clause" in the contract.

c. Ambiguities. If the contract is considered to be ambiguous, the ambiguity must be construed against the drafter of the language. This too is a fundamental legal principle and is equally applicable to the government as well as the contractor. Thus, if the government is the "drafter," any ambiguities will be construed against the fovernment. Obvious

ambiguity, however, places on the other party a duty to seek clarification. Failure to do so will undermine later claims based on the ambiguous language.

d. Presumption of Adequacy of Government Specifications. Where the government furnishes design specifications which control work under the contract there is a presumption that the specifications are adequate for the purposes intended and that if followed the desired result will be obtained. There is, in effect, an "implied warranty" that the specifications are adequate.

e. Effect of Contractor's Knowledge of Defective Specifications. The precedent is also well established that where a contractor is required to proceed under specifications which are defective or incomplete or which make the contract impossible to perform, such situations form a basis for price adjustment under the "Changes" clause, together with necessary time extensions to delivery schedules, even though the unattainable requirement is ultimately relaxed to permit performance.

However, if the contractor knows, or perhaps from his experience should know, that the desired result cannot be obtained, he cannot make a useless thing and expect to be able to charge for it. Where the contractor knows, or should have known, that the specifications are defective he is under a duty to apprise the government of this. He discharges his obligation by making the defect known to the government. The government then has a duty to act. Additionally, where specifications are defective on their face, or obviously unsuitable, the contractor has a duty to inquire; if he fails to so inquire he cannot successfully advance a claim of excusability.

f. Workmanlike Performance. Strict compliance with the specifications is not the contractor's only responsibility. He is also under a basic duty to perform in the best and most workmanlike manner. This requires a performance standard equal to that of a qualified, careful and efficient person performing similar work. This is so, even if the standard is not set forth in the contract. When the contract does not contain detailed specifications a test of "skillful and workmanlike" performance is good industry practice.

g. Order of Preference. Sometimes conflicts appear between the basic contract and the specifications or drawings, or between the specifications and drawings. Generally speaking, when there is a conflict between the contract and the specifications

or drawings, the terms of the contract will prevail; if the conflict exists between the specification and drawings, the specifications will prevail. However, if the document of precedence is silent on the matter and the matter is not in conflict with some other provision, the "lesser" document will prevail. For example, if the drawings provide for something which is not in the specification, and it is not in conflict with the specifications or the basic contract document, the drawing would prevail to that extent. This is necessarily so under the rule above, that the contract must be read as a whole.

h. Impossibility of Performance. Generally, when a contractor undertakes to perform under a performance specification he generally assumes the risk that he can, in fact, accomplish the end result. When he agrees to so perform, it is presumed that he knows the "state-of-the-art." Furthermore, the parties are presumed to have entered into the contract in the belief that the state-of-the-art was such that performance was possible.

When performance requirements cannot be met, contractors, on occasion, advance the argument that the specifications were impossible of performance. Generally, when the performance specifications are those of the government and are impossible to perform, the contractor will be relieved of compliance.

The real question in issue in these instances is whether the level of performance called for is beyond the reach of any contractor in the field or is merely beyond the capability of the contractor concerned. If the latter, an impossibility of performance situation would not exist. When the contractor is a leader in its field, the argument of "impossibility" is considerably weakened and the position much more difficult to maintain.

i. Alternate Methods of Performance. Where alternate methods of performance are permitted by the specifications, the contractor has the freedom of choice. However, if one method is either impossible to perform, illegal, or more costly, the contractor is expected to follow the other method.

GENERAL RULES APPLICABLE TO PERFORMANCE UNDER SPECIFICATIONS

The following are general rules applied to questions involving performance and specifications. It should be noted that individual circumstances can alter their application.

a. When the government provides complete design information there is an implied warranty that an acceptable product will result if specifications are met.

b. If frustration is encountered in determining the meaning of conflicting or ambiguous specifications, interpretation will be in favor of the contractor if the language was written by the government.

c. The government is entitled to strict compliance with quantitative specifications although substantial compliance may be held to be sufficient (for example, 2,000 rpm).

d. Qualitative specifications are interpreted in the light of custom and usage in the particular trade or profession (for example, watertight).

e. Process information supplied by the government on a permissive or information basis does not warrant commercial practicability.

f. If a contractor's proposal is included as a part of the specifications, there is a possibility that the contractor may be held to the performance suggested by the proposal (technical message as opposed to marketing message)

g. A contractor may not sit back and rely on a patent ambiguity in specifications and then demand a compensable change. He has an obligation to address such ambiguity to the attention of the contracting officer prior to bid submission.

h. Requiring either a greater or lesser performance than called for by contract is a "constructive change" entitling the contractor to an equitable adjustment under the Changes clause.

i. Research and development contracts usually do not contain design specifications since the contractor is generally required to design and build the item to meet performance specifications.

j. In the event of a discrepancy between design specifications and performance specifications, the performance specifications generally control.

k. Most contracts provide that in addition to what is shown on the plans and what is spelled out in the specifications, the contractor shall be compelled to furnish and do whatever is necessary to provide a complete system or do a complete job. The test used is what should a reasonable contractor deduce from the plans and specifications.

l. Where the language of the specification is indefinite, ambiguous, or of doubtful construction, the practical interpretation of the parties, as evidenced by usage or course of dealing, controls.

## CONCLUSION

If this chapter has developed in the project engineer's mind a concern for the legal implications and problems that a statement of work can precipitate, it has achieved its purpose. A project engineer who keeps the legal considerations in mind while he is writing the SOW has taken the proper initiative needed to preclude legal problems for his project during the life of the contract. However, a word of caution is appropriate here. A project engineer should avoid assuming the legal procurement role for his project. The legal consequences could be disastrous. Neither the contents of the chapter nor years of R&D contract management experience will prepare a project engineer for assuming this expertise. He had better actively seek out the advice and assistance of the procurement and legal personnel. It is needed to evaluate the legal implications and the potential legal problem areas that he may be inadvertently including in his statement of work before it is ever awarded for performance to a contractor. He should additionally return promptly to the same personnel when it appears that potential legal problems are developing on his contract. Remember "The lawyer who represents himself has a fool for a client."

# CHAPTER 9

# POST STATEMENT OF WORK CONSIDERATIONS

## INTRODUCTION

With the completion of a quality statement of work that has received the approval of all the personnel in the SOW coordination cycle and the procurement/legal review process, the project engineer has essentially completed the most important task in the array of precontractual considerations for his R&D project. It is the purpose of this last chapter to identify some points to be pursued by the project engineer to assure the receipt of quality technical proposals from industry in response to his statement of work.

## PURCHASE REQUEST (PR) PACKAGE DOCUMENTATION

The statement of work is only one element in the document which the project engineer sends to procurement in order to obtain technical proposals from industry for his R&D effort. This document, called a Purchase Request (PR) Package, will normally contain a number of other forms or subdocuments which provide specific support to the SOW requirements. Some of these additional subdocuments are:

a. The Purchase Request Form.

b. A desired schedule for SOW task accomplishment.

c. A request for Determinations and Findings (as appropriate).

d. A Technical Evaluation Plan.

e. Technical Evaluation Criteria.

f. A Consolidated Data Requirements List and supporting Data Item Descriptions.

g. A Security Requirements Checklist (when appropriate).

h. A Sole Source Justification (when appropriate).

i. A List of Qualified Potential Contractors.

j. A Synopsis of the Procurement for the "Commerce Business Daily."

It is impossible to generate a comprehensive list that would be applicable to all R&D procurements. The above list is just a sample. The personnel in procurement and the internal laboratory PR coordination cycle can tell the project engineer exactly what documents must accompany his SOW in the PR package. The project engineer should identify and prepare all these required documents prior to entering the PR coordination cycle with his project. It may preclude delays in the procurement cycle that can be precipitated by incompletely documented PR packages.

## SELECTION OF QUALIFIED POTENTIAL CONTRACTORS

A quality statement of work would be meaningless if it is not sent to contractors who are qualified to perform the technical effort required. The project engineer must work very closely with his Procurement Contracting Officer in order to assure that all qualified contractors have been identified and that they will all be invited to submit technical proposals. This identification should be completed well in advance of the formal submission of the PR package to procurement. The reason is rather obvious. No project engineer would appreciate a last minute delay in the procurement processing of his PR package because all of the qualified potential contractors had not been properly identified. Consequently, the project engineer should assist and cooperate with the procurement procedures that enhance a timely identification of qualified contractors for his project.

## INSTRUCTIONS FOR PREPARING TECHNICAL PROPOSALS

As mentioned earlier in this chapter, two of the elements in a PR package are the Technical Evaluation Plan and the Technical Evaluation Criteria. They serve as the basis for the procurement generated "Instructions for Preparing Technical Proposals" which is sent to contractors at the same time that the technical proposals are solicited. It serves to guide the contractors in the preparation of responsive technical proposals thereby broadening the base for a competitive procurement.

Contractors frequently are given a much shorter period of time to submit their proposals than the project engineer had to prepare his SOW. As a result, the project engineer should incorporate into the PR package enough guidance concerning Technical Evaluation to allow a contractor to determine the important aspects of the proposed R&D effort. Prospective contractors should be informed about the

relative importance of the technical proposal evaluation factors that will be applied to the proposals. This assures that all potential contractors will submit and have their proposals evaluated on a common basis. However, the specific criteria for the valuation are not disclosed to the prospective contractors. To do so might be tantamount to forcing the contractors' proposals to emphasize more evaluation criteria adherence and less creativity and responsiveness to the technical requirements of the SOW.

One concern that always comes to mind when contractors are preparing proposals is "Just how important is it to strictly adhere to the SOW requirements while writing a technical proposal?" Are deviations to the SOW permissible or will they prejudice the technical merit of the proposal? As a result one of two alternatives should be pursued. If new ideas and fresh approaches are desired in technical proposals, inform all potential contractors through the PCO that deviations or alternate proposals will be considered if the contractor can demonstrate that the government will benefit from the deviations. The second alternative is to inform the prospective contractors to rigidly adhere to SOW requirements. However, if this second alternative is utilized, it should be additionally emphasized that a technical proposal that merely "parrots" the SOW is not an acceptable proposal. The relative importance of the technical proposal evaluation factors may need reiteration if this alternative is utilized.

One final point should be specifically included in the Instructions to the contractor. All contractors should be advised that, while they are writing their technical proposals, all questions concerning the SOW requirements or any other aspect of the solicitation must be routed through the Contracting Officer. The project engineer should answer no questions until he has the specific authorization of the Contracting Officer. When permission has been granted and the answers are formulated, the information should be transmitted to all contractors preparing proposals. As a result of such procedures, no contractor gains a competitive advantage over another by circumventing the Contracting Officer and directly asking the project engineers for information.

PREPROPOSAL BRIEFINGS

Official preproposal briefings of prospective contractors may be held when an R&D project is too complex or general to allow proper detail of background to be included in the PR package and the resulting Solicitation. Where possible, only

one briefing is given so that uniformity of information is provided. This briefing, however, must not be used by a project engineer in an effort to preclude the writing of a detailed statement of work.

A preproposal briefing may be given whenever any of the following conditions exist:

a. The procurement can be awarded on a competitive basis, and it is important that all firms receive equal information.

b. A significant savings can be effected in technical manhours by explaining details of the procurement on a group basis.

c. Separate visits by prospective contractors result in recurrent disruptions of an entire technical group because of the location or use of a model or the limited availability of reference materials.

d. Close control of prospective contractor's visits is desired by the project engineer for security or other reasons.

e. Industry has shown a lack of interest in this area of endeavor, and a concerted effort is desired to arouse interest.

f. Laboratory supervision has determined that it is otherwise warranted.

The Contracting Officer will conduct the briefing. A complete record of the briefing will be made. The project engineer will ensure that the proper technical personnel are available for participation and that pertinent data or models are available for presentation.

# APPENDIX A

# TECHNICAL RISK AND THE SELECTION OF CONTRACT TYPE

## TYPES OF CONTRACTS

The selection of the proper type of contract is an integral part of the R&D procurement process. The term "type of contract" generally conveys three meanings - form, end purpose and compensation arrangement.

Type of contract related to form. Form refers to the construction of the contract as it pertains to terms and conditions, for example, letter contract, definitive contract, basic agreement, etc.

Type of contract related to the end purpose. End purpose pertains to the purpose for which the contract is consummated, for example, an end purpose might be to procure supplies, services, construction, research and development, etc.

Type of contract related to the compensation arrangement, for example, Firm Fixed Price, Cost Plus Fixed Fee, etc. Consideration of the types of contracts as they pertain to compensation arrangements is the central focus of this appendix. If the phrase "types of contract" or "contract type" reappears in this appendix, it should be understood to mean type of contract relating to compensation arrangement.

The choice of the type of contract can be a very simple task or require considerable thought depending on the situation. In a competitive situation for a rather simple well defined item, the choice will be a Firm Fixed Price (FFP) contract. If the item is quite complex and not easily defined, the choice will be something other than an FFP contract. In any event, the "Buyer" will have to exercise judgment in the selection of a type of contract. Some factors he must consider are the risk involved in production, the clarity of the specifications, the terms and conditions of the contract, the contractor's competitive posture, etc.

The selection of contract type is a matter of major interest to both the Department of Defense (DOD) and industry. As such, policy pertaining to selection of contract type is in a constant state of evolution. The basic structuring of contract type, however, remains unchanged. Since this is the case, the Buyer with a firm foundation in understanding the basic structures of contract types will be able to readily adapt, in a fair and reasonable manner, to meet the challenge of the changing environment. The buyer should be aware of a major limitation inherent in his position----the fact that he deals only with an instant contract. Although the contractor is motivated by long run profit to obtain his long range goal of survival, in the short run, he may be willing to sacrifice profits based on full cost in order to help cover his variable costs and a portion of his fixed cost.

## TECHNICAL RISK RELATED TO TYPE OF CONTRACT

In order to realistically choose a type of contract that meets a specific situation, an effective appraisal of technical risk must be undertaken. This analysis of risk for a complex system must include appraisals by a team of technical experts which will include personnel from Engineering, Requirements and Procurement. After review of technical risk and quantification of risk factors into dollars, the Buyer will have an approximation of the dollar risk involved. This will provide a starting point for determining the proper type of contract.

Figure A-1, Technical Risk Related to Contract Type, is a visual presentation of how the adequancy of the requirement definition generally related to technical risk and the type of contract. The type of contract shown for any specific condition is not necessarily the best for an actual situation. Each case must stand on its own. The essential differences between a Fixed Price type of contract and a Cost Reimbursement contract are the conditions, that is, in a Fixed Price Contract the specified product must be delivered, whereas, in the normal Cost Reimbursable contract, costs will be reimbursed regardless of product delivery if they are allocable, allowable, and reasonable. Several generalities should be reviewed in conjunction with Figure A-1.

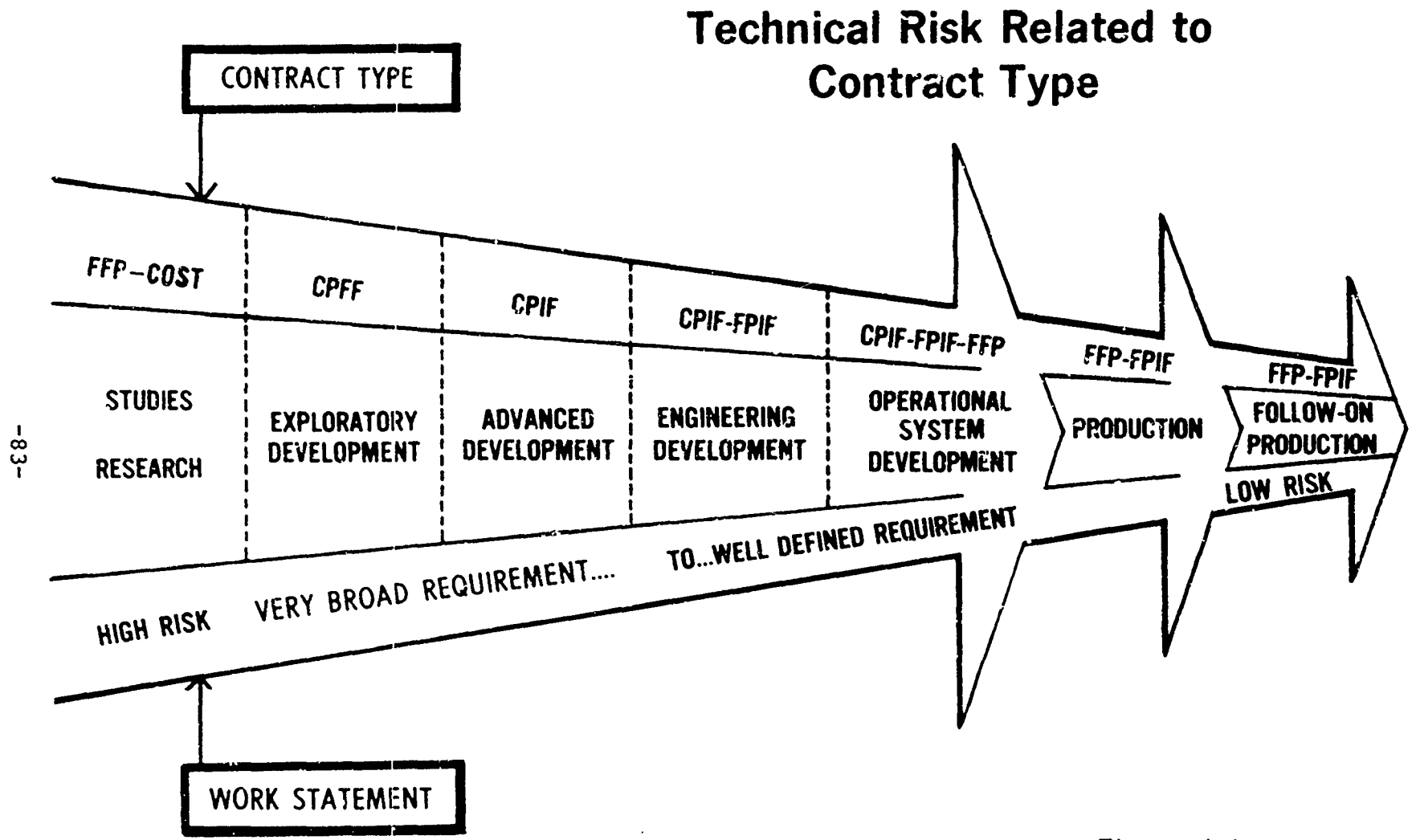
Technical Risk Related to Contract Type
CONTRACT TYPE
FFP-COST
CPFF
CPIF
CPIF-FPIF
CPIF-FPIF-FFP
FFP-FPIF
FFP-FPIF
STUDIES
RESEARCH
EXPLORATORY DEVELOPMENT
ADVANCED DEVELOPMENT
ENGINEERING DEVELOPMENT
OPERATIONAL SYSTEM DEVELOPMENT
PRODUCTION
FOLLOW-ON PRODUCTION
HIGH RISK
VERY BROAD REQUIREMENT....
TO...WELL DEFINED REQUIREMENT
LOW RISK
WORK STATEMENT

Figure A-1

a. As the requirement progresses from an ill-defined requirement to a well defined requirement, the technical risk will be reduced from a high to a low level.

b. Research and development contracts generally have rather high technical risk associated with them. This is due to the factor of ill-defined requirements which arise from the necessity to deal beyond, or at least very near the upper limits of the current technology (often called "the state-of-the-art").

c. The types of contracts generally associated with ill-defined requirements are Cost or variations of Cost type contracts. As the requirement becomes better defined, the type of contract transitions from the Cost type to the Fixed Price type of contract. If the requirement can be adequately defined, an FFP contract may be used.

A summary of the fixed price and cost types of contracts, their applicability and advantages and disadvantages to the government and contractor are presented in Figures A-2 and A-3.

## Figure A-2 - SUMMARY OF TYPES OF CONTRACTS - FIXED PRICE

Range of contract types, with their theoretical advantages and disadvantages

| Contract Type | Application | Advantages to Government | Disadvantages to Government | Advantages to Contractor | Disadvantages to Contractor |
|---|---|---|---|---|---|
| Firm-Fixed-Price | Where fair and reasonable price can be established at outset. For example, where there definite design or performance specifications, realistic estimates, adequate competition, valid cost or pricing data providing reasonable price comparisons. | Shifts total risk to contractor. Minimum administration. Simplifies budgeting. Some degree of price competition. Uniformity for bid evaluation. Contractor responsible for management. Well-defined work statement and specifications. | Presolution of design problems Price must contain contingencies. No in-process control of work. | Potential for higher profit. Minimum government control. Well-defined specifications; better cost estimates. Less financial audit. | Total assumption of financial and technical risks. Risk of loss liability for work in process. Requires vigilance to institute change claims. |
| Fixed-Price with Escalation | Where market or labor conditions are unstable over extended production period. Where contigencies must be identified and covered separately by escalation. | May result in downward adjustments. Contractor responsible for management. Reduces contingency dollars in price. | Increased administrative costs. | Spreads risk. | Contains absolute ceiling. Escalation limited to industrywide contingencies. Contingencies within contractor control excluded. |
| Fixed-Price-Incentive (cost only) | Where cost uncertainties exist and there is the possibility of cost reduction and/or performance improvements by giving contractor: a. a degree of cost responsibility and b. a positive profit incentive. | Spreads risk. Less reason for contingencies in price. Encourages efficiency. Contractor responsible for management. No ceiling on incentive for efficiency. | Increased administrative costs. Must budget to ceiling price Complex negotiations. | Potential for higher profit for higher risk. Rewards good management. | Price Ceiling Government verification of costs. Complex negotiations. Government tends to treat as cost type, contract controls, cost principles, and so forth. Limits technical innovation. |
| Fixed-Price Redeterminable | A. Prospective. For quantity production or services where realistic price can be negotiated initially but not for later period(s) of performance. | Possibility of downward adjustment. | Little motivation for cost reduction. | Reduces risk. | May include absolute ceiling. Government verification of accounting records. |
| | B. Retroactive. Where a fair and reasonable FFP can not be negotiated and the amount involved is so small or the time for performance so short that the use of contract is impractical. | | Little motivation for cost reduction. | Very limited risk. | Ceiling Price. More detailed accounting records. Government verification of accounting records. |

Modified from Exhibit IV entitled Range of Contract Types, With Their Theoretical Advantages and Disadvantages from "Major DOD Procurements at War With Reality" by Hudson B. Drake (January-February 1970) Harvard Business Review. Permission granted by Harvard Business Review (16 November 1972) to modify and reprint.

Figure A-3 - SUMMARY OF TYPES OF CONTRACTS - COSTS

Range of contract types, with their theoretical advantages and disadvantages

| Contract Type | Application | Advantages To Government | Disadvantages to Government | Advantages to Contractor | Disadvantages to Contractor |
|---|---|---|---|---|---|
| Cost | Where performance is uncertain and reasonable cost estimates impossible | No fee | No motive to reduce cost.<br>Government partially responsible for management | Minimum risk<br>Assures recovery of cost | No fee |
| Cost Sharing | Where development of research projects is jointly sponsored by government and contractor, and there is a high probability of commercial benefit | No fee<br>Bears only portion of cost.<br>Motivates for cost reduction | Limited to certain R&D cases<br>Limits competition<br>Must show conclusive evidence of probability of commercial benefit | Government participation in commercial development | Cost share may be excessive |
| Cost-Plus-Incentive Fee | For development and test when incentive formula can provide inducement for effective management.<br>Where feasible, performance incentives used together with cost and schedule incentives | Shared risk<br>Motivates for cost effectiveness through bonus-penalty arrangement.<br>Limited price contingencies<br>Cost visibility | Overrun costs<br>High administrative costs | Limited risk<br>Possibility of increased fee<br>Assures recovering costs<br>Rewards good management | Reduced fee because of reduced risks<br>Absolute limit on fee<br>Disallowance of certain normal business costs<br>Government engagement |
| Cost-Plus-Fixed-Fee | Where performance is uncertain and accurate cost estimates are impossible. For research or other development effort when the task or job can be clearly defined, a definite goal or target expressed, and a specific end product desired | Emphasizes performance objectives | Low motivation for cost efficiency<br>High risk<br>Not for development of major weapons once exploration indicates engineering development feasible<br>Maximum administrative burden<br>Funding uncertainties<br>Settlement of final costs is prolonged | Low cost and technical risk<br>Assures recovery of cost | Maximum government controls and reporting<br>Disallowance of certain normal business costs<br>Lower fee because of lower risks |
| Cost-Plus-Award Fee (Award Fee feature may be used in conjunction with other contract types) | Where firm incentive objectives for cost, technical and management performance are not practical. Should not be used if improved level of work or acceptable work cannot be defined. | Unilateral determination of award fee<br>Motivates contractor's management by reward for superior performance | Administrative cost<br>Complex negotiation | Low Risk<br>Fee increase for good performance<br>Assures recovering cost | Unilateral determination of award fee by Government (Disputes clause does not apply)<br>Complex negotiation |
| Time & Materials Labor Hour | Where impossible to anticipate cost (time and material or labor hours) with any reasonable degree of accuracy when the contract is placed. | Necessity for close surveillance provides good cost visibility | High administrative cost | Very low risk<br>Assured profit rate | Costs allowed in accordance with ASPR Sec XV<br>Ceiling Price |

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